STEEL

CRUCIBLE "Full-Range" SPECIALTY STEEL SERVICE

HIGH SPEED
TOOL
STAINLESS
CRUCIBLE'S
Full-Range
SPECIALTY STEEL
SERVICE
ALLOY
PRODUCTION
SPECIAL PURPOSE

"CALL ON CRUCIBLE"
Your Centralized Source of all Specialty Steels

ST. PAUL
DETROIT
CHICAGO
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HARRISON
PITTS
DELPHIA
MORE
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ATLANTA
DENVER
SAN FRANCISCO
LOS ANGELES

★ Each Star is a Crucible Branch-Warehouse

● Each Dot is a Crucible Distributor or Jobber

SPECIALTY STEELSMITHS to INDUSTRY

CRUCIBLE STEEL COMPANY of America

CHRYSLER BUILDING • 405 LEXINGTON AVENUE • NEW YORK CITY
BRANCHES, WAREHOUSES AND DISTRIBUTORS IN PRINCIPAL CITIES

CONSULT TELEPHONE DIRECTORY OR THOMAS' REGISTER FOR NEAREST OFFICE

BORIZING

What it is and What it does

Borizing or precision finishing is a high-accuracy machining process which has generally replaced boring, reaming, facing, turning, milling and often times grinding wherever extreme precision is required. By this method accuracy can be maintained in production to .0002" and closer for size, roundness and straightness, finish as close as 8 micro inches. Borizing assures consistent duplication of accuracy with minimum scrap and rejections without penalizing production, which is maintained at rates equal to and in most cases better than other methods.

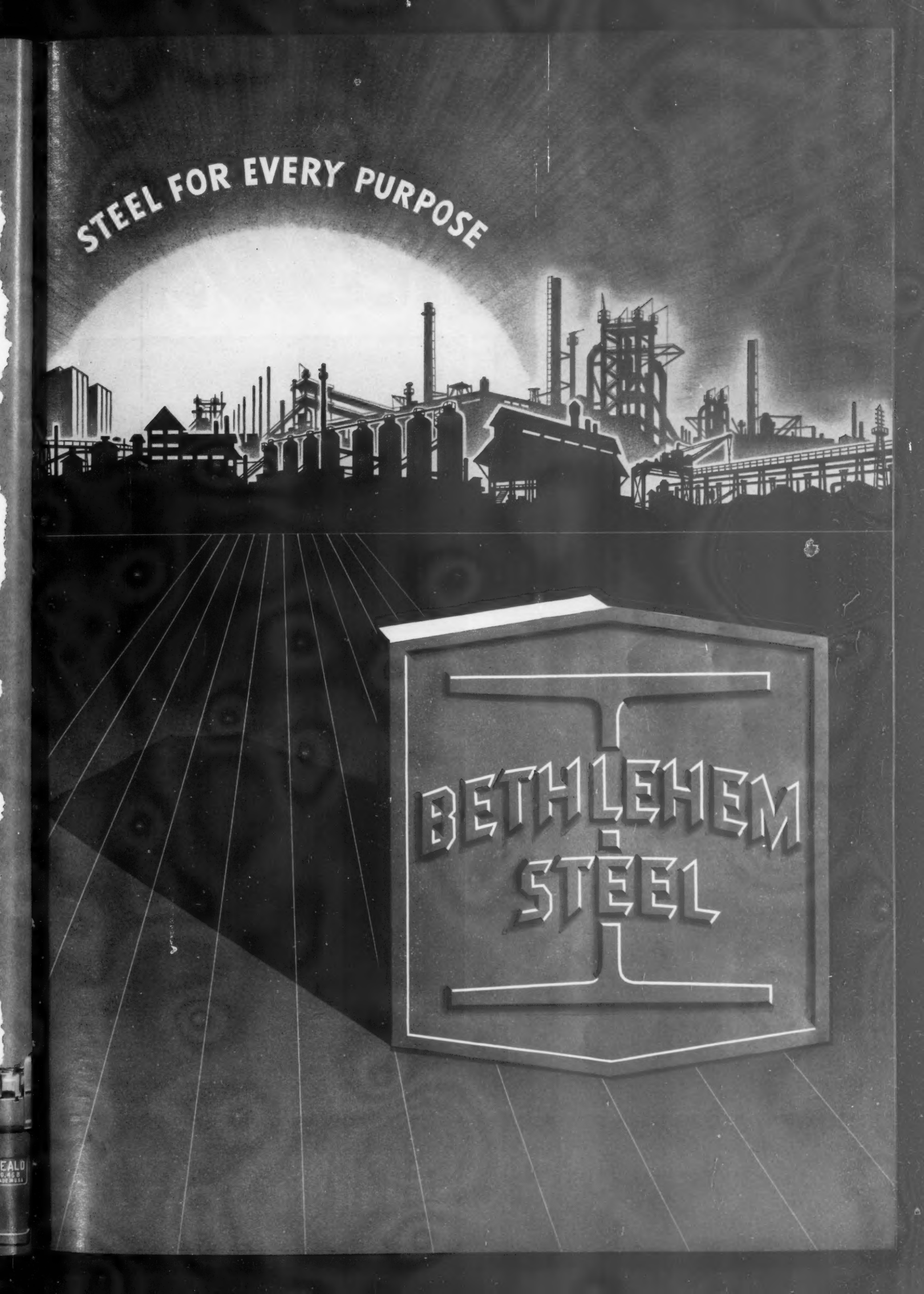
To handle the borizing process, special machines such as Heald Bore-Matics have been developed. These machines use tools tipped with tungsten carbide (sometimes diamond) which is outstanding in its ability to maintain a cutting edge over long runs. In conjunction with tungsten carbide cutting materials borizing machines employ single-point tools, high surface speeds, and relatively light cuts, these factors making possible improved finish and accuracy through reduced feed lines and tool pressure.

The last degree of precision possible from this process is insured by many invaluable features which have been incorporated in the design of Heald Bore-Matics. In Bore-Matics you'll find extremely rigid construction throughout, velvet-smooth hydraulic table control, force feed lubrication to table ways, ample flat and V ways for stabilized table travel, smooth, powerful V belt drive to boring heads, super-precision bearings with automatic preloading in boring heads — in fact, in Bore-Matics you'll find every feature for smooth vibrationless operation so essential in borizing.

Practically every type of material except hardened steel can be finished by borizing. Heald Bore-Matics will handle aluminum, brass, bronze, copper, lead, zinc, carbon, cast iron, soft steel, stainless steel, monel metal, etc. These materials can be not only precision bored on Heald Bore-Matics but also precision turned, faced, grooved and chamfered, either singly or in any combination as multiple cuts.

Many years of service in leading aircraft, electric refrigerator and automotive plants have conclusively proven the value of the borizing process and Heald Bore-Matics as a production tool.

THE HEALD MACHINE CO.
WORCESTER, MASSACHUSETTS, U. S. A.


STEEL FOR EVERY PURPOSE
BETHLEHEM
STEEL

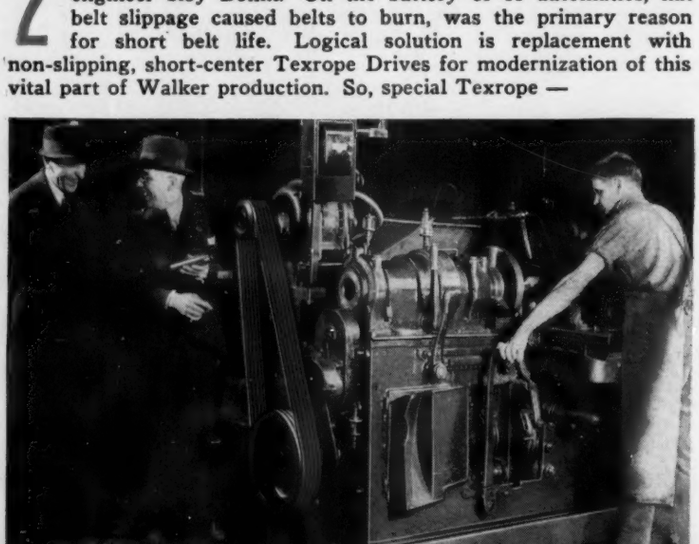
READ HOW TO Return

HOW WORLD'S LARGEST JACK MANUFACTURER DOES IT WITH ALLIS-CHALMERS TEXROPE!

1 WORLD'S LARGEST JACK-MAKER — THAT'S THE Walker Mfg. Co., Racine, Wis. Big problem to Walker Foreman, Francis Pfister, is flat belt replacement on automatic screw machines . . . required on an average of every three or four weeks. Since these belts cost $27 apiece, he calls this problem to the attention of Supt. John E. Jensen, who —

2 ENLISTS THE HELP OF TEXROPE TRANSMISSION engineer Roy Bonin. On the battery of 15 automatics, flat belt slippage caused belts to burn, was the primary reason for short belt life. Logical solution is replacement with non-slipping, short-center Texrope Drives for modernization of this vital part of Walker production. So, special Texrope —

3 RIM SHEAVES ARE ACCURATELY MACHINED IN the Allis-Chalmers plant, then pressed on original flat pulleys. As a result, expensive clutch drums inside the flat pulleys need not be duplicated for the V-belt replacements. With minimum production interruption, screw machines are stopped one at a time, pulleys sent to Allis-Chalmers. Soon after —



4 TEXROPE-EQUIPPED PULLEYS ARE RETURNED to the Walker plant, where Supt. Jensen enthusiastically inspects advantages of Texrope V-belt transmission applied to his machines. Now matched sets of genuine, short-centered Texrope belts make these automatics more compact, more efficient, give operators more accurate control. What's more —

TEXROPE DRIVES CUT

INVEST $645 AND GET A *of $10,000 in Two Years!*

5 INSTEAD OF PAYING $27 PER BELT EVERY three weeks, Foreman Pfister graphically reports original Texrope belts are completing two years operation . . . *without a single replacement!* Costing initially $43 per unit, these changeovers paid for themselves in less than two months . . . *have saved an estimated $10,000 in belt replacements since!*

6 WELCOME, THEN, TO WALKER PRODUCTION men, is the money-saving story of modern Texrope V-belt transmission. Performance is Texrope's ace salesman . . . and, not only at Walker, but throughout industry in hundreds of varied applications, Texrope is solving many difficult problems, bringing low-cost transmission wherever it is applied!

Here's How You Can Jack-Up Lagging Production Schedules . . . with Allis-Chalmers Texrope! Get the Story of Texrope Co-operative Engineering Service and What it Means to You in Dollars and Cents Savings!

There's more to a drive than just sheaves and belts! That's why . . . before Allis-Chalmers sells a drive, a highly skilled Texrope transmission engineer analyzes your problem . . . figures the kind of drive or transmission equipment that will give you the highest standard of performance and save you dollars at the same time!

What's more . . . you get this valuable *extra-value* feature . . . this *money-saving* co-operative service . . . at *no extra cost!*

No wonder production men in a world of industries make Texrope their first choice . . . call on Texrope for the high degree of money-saving performance only a precision engineered drive can give them!

So get Texrope . . . and get ahead of transmission troubles! Call your nearest Allis-Chalmers district office or Texrope Dealer for the whole story of Texrope's co-operative engineering service!

A 1315

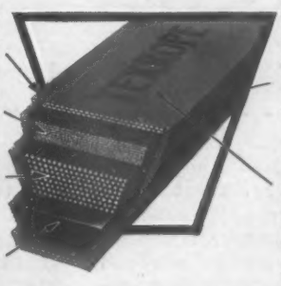
WHEN ORDERING REPLACEMENTS, REMEMBER . . . ONLY TEXROPE V-BELTS GIVE YOU ALL THESE OUTSTANDING FEATURES!

Extra-tough, two-ply cover gives EXTRA-PROTECTION against abrasive wear . . . eliminates need for belt dressing of any kind.

Special bias cut fabric adds transverse strength . . . provides DOUBLE SAFETY against belt breakage.

Rugged load-carrying cords, impregnated in a special, cool-flexing gum insure unvarying length . . . GREATER strength . . . MORE pulling power.

Amazing cool-running rubber compound absorbs shock . . . assures silent, vibrationless operation . . . ACTUALLY INCREASES BELT LIFE 100 TO 200% OVER BELTS OF ONLY A FEW YEARS AGO!



Belts by Goodrich

Texropes are TRUE V-BELTS . . . with famous STRAIGHT-EDGE WEDGE design that gives efficiencies up to 98.9% . . . prevents slipping, jerking. Because they are matched in a special precision measuring machine, sets of Texropes are uniform to a fraction of an inch in length — your guarantee of equalized pulling . . . even wear . . . longer life.

LOOK for the name TEXROPE . . . stamped on every belt! It identifies the only GENUINE Texrope . . . backed by Allis-Chalmers, originators of the multiple V-belt drive. You can get genuine Texropes and Texrope Drives instantly from Allis-Chalmers warehouses and distributor stocks throughout the world.

TRANSMISSION COSTS

Reader COMMENTS

Readers are invited to comment upon articles, editorials, reports, prices or other editorial material appearing in STEEL. The editors cannot publish unsigned communications, but at their discretion may permit a writer to use a pseudonym when a bona fide reason exists for with-holding his identity. Letters should be brief—preferably not exceeding 250 words

Good Job Well Done

To the Editor:

I want to drop just a line of commendation on the recent machine tool compilation which you have issued, entitled "How to Earn Profits with Modern Machine Tools." In such a book as this your publication performs a service which is almost impossible of duplication by any other agency.

Fundamentally, you are a news gathering and publishing organization. Although most shops would not like to admit the fact, this book would actually constitute news in more places than one might suspect. A booklet such as you have offered in this publication might jog some of these people to some intelligent thinking, where your regular issues might go by unnoticed, because of the subtleness of its implications. You have done another good job in this book and certainly you and your staff can be justly proud of it.

PAUL E. HECKEL

Executive assistant,
Cincinnati Bickford Tool Co.,
Cincinnati

Canada Solving Problems

To the Editor:

Your very flattering remarks about the capabilities of Canadian engineers in STEEL some time ago make me feel good. We have a great deal to contend with in Canada as production units are not ordered in the same volume as you would normally get in American production. This is quite a serious problem and very often this tricks the tool engineer in spending money. You can readily realize that to go ahead on a job where you were going to make 100,000 parts would be much simpler than turning out 6000 or 7000 parts. This applies, of course, to commercial production.

The war, however, has brought to Canadian shops a greater realization of mass production, because units will be produced in unlimited quantities. I recently made an interesting visit to a fuse plant in Canada and comments on the story will be appreciated.

R. C. TIPLADY

Editor Canadian Machinery,
481 University avenue,
Toronto, Ont.

Praise from Briton

To the Editor:

Many thanks for your most interesting and instructive book, "How To Earn Profits with Modern Machine Tools."

Your idea of placing before works executives the latest methods of production and machines used in these is an admirable thought and I am sure will meet with the success it so richly deserves.

R. KEGO

New York director,
Charles Churchill & Co. Ltd.,
Birmingham, England.

Hopes for Highway Justice

To the Editor:

It is a hopeful sign when a movement is started toward uniformity in laws governing use of highways by trucks. Reading in STEEL, Dec. 16, page 42, that congress, department of commerce and the interstate commerce commission are getting their heads together to this end I felt that something may work out of the effort to relieve this growing industry of a burdensome series of regulations that differ in almost every state.

Some of the state laws have been passed in an open effort to keep trucks from adjacent states from operating but probably most have been honest efforts to make the highways safer or to obtain from the truckers an adequate return for use of expensive highways. The effect in many instances has been practically to raise a tariff barrier against a neighboring state and to interfere with interstate commerce as it is carried on the highways.

Uniformity of railroad practice has been attained by efforts of the interstate commerce commission and there are few differences between states, except here and there.

Use of trucks in transporting a large volume of freight on the highways is a recent growth and some states have seized on the opportunity to penalize the trucker by excessive license fees, by regulations that are a hardship and by discriminating against vehicles licensed in other states.

The interstate commerce commission has been assuming more and more authority over highway haulers in the past few years and now that its attention has been called to the hodge-podge of regulatory laws that interfere with free interchange of traffic we truck owners are hopeful some relief will be given.

As the situation is at present, trucks from one state might find it impossible to carry a load across half a dozen states without great delay and difficulty. Truck transportation has come to stay and reasonable regulation is welcomed by operators, for the good of all.

TRUCK OPERATOR

Buffalo

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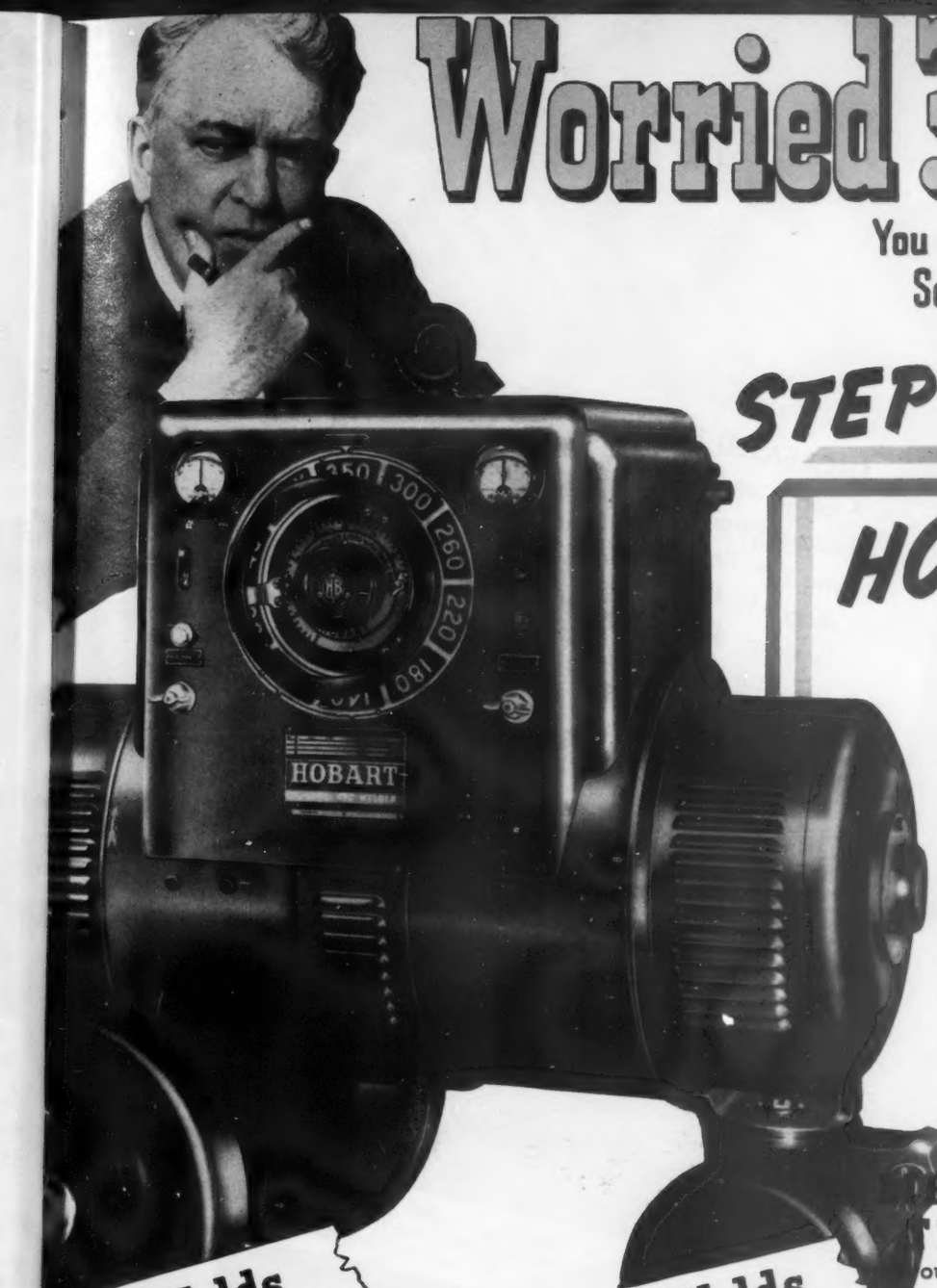
Vol. 108, No. 1, Jan. 6, 1941, issue of STEEL, published every Monday at Cleveland, O. Entered as second-class matter at the postoffice, Cleveland, O., under act of March 3, 1879. U. S. and Canada, 1 year $4; 2 years $6; foreign countries, 1 year $10; Current issues, 25c

Worried? ... Because You Can't Deliver?

You Can Meet Fast Delivery Schedules When You

STEP UP PRODUCTION with HOBART "Simplified" Arc Welding



Delays are expensive, rejects costly! You can't afford to take chances with slow production welding when every minute lost means dollars. With Hobart it's an easy matter to produce better quality welds with greater speed. Exclusive Hobart features of the new Hobart Multi-Range Arc Welder guarantee top performance! Remote Control saves time and labor; Multi-Range Dual Control lets you select the correct welding heat from 1000 combinations of voltage and welding current. Get more profit by completing important production schedules in less time with a Hobart! Use coupon for details.

HOBART BROTHERS COMPANY
Box ST-11, TROY, OHIO

"One of the World's Largest Builders of Arc Welders"

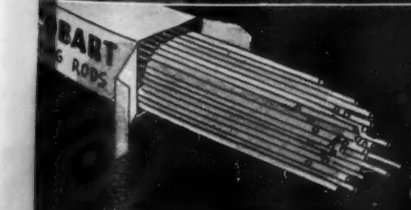
BERAL TRIAL
our own work prove it pays!

GET YOUR ORDER IN **NOW** *to Get Delivery*

Welds Faster!

Welds Easier!

Fewer Rejects!



HOBART WELDING RODS
eposited weld metal produces an xcellent weld surface of fine grain tructure. A complete line.

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THE FASTEST SELLING ARC WELDER ON THE MARKET TODAY

☐ **FREE!** This book, full of examples of welding applications and the many profitable uses of welding on production and maintenance. Write for it!

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BOX ST-11, TROY, OH

Please tell me more about Hob Arc Welders, especially on items checked below:

☐ Electric Drive
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☐ Liberal Trial
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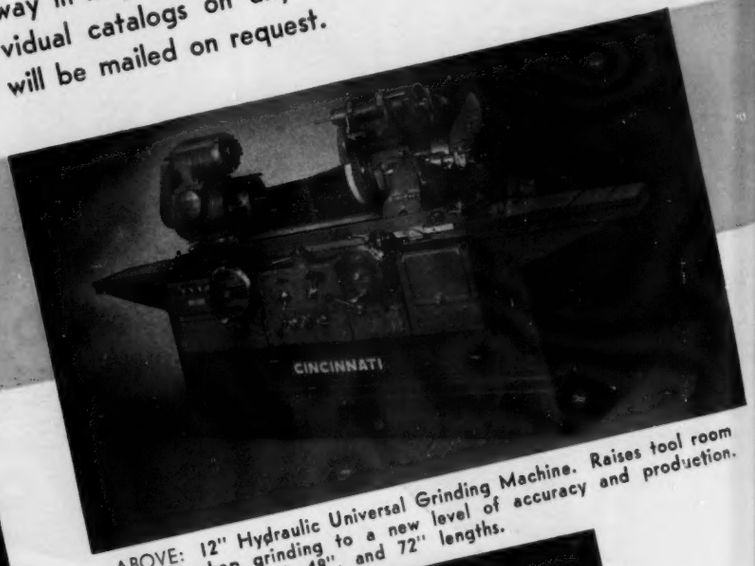
CINCINNATI

FOR YOUR Production

INCREASED industrial activity, both in the emergency and standard classifications, often presents unusual opportunities for reducing unit costs. Perhaps you can find many such opportunities in your own shop. In the fields of milling, grinding, broaching, lapping, die sinking, and cutter sharpening, machines bearing the CINCINNATI trade-mark will go a long way in helping you to lower your shop costs. Individual catalogs on any of our standard machines will be mailed on request.

ABOVE: No. 5-54 Duplex Hydro-Broach Machine. A continuous producer; broaches part in one station while other station is being loaded. Convenient for installation in production line. Made in seven sizes, from No. 1-30 to No. 10-66.



ABOVE: 12" Hydraulic Universal Grinding Machine. Raises tool room and job shop grinding to a new level of accuracy and production. Made in 24", 36", 48", and 72" lengths.

RIGHT: No. 0-8 Plain Automatic Milling Machine, equipped with rise and fall spindle carrier. A rapid producer for very small parts.

ABOVE: No. 0-8 Vertical Milling Machine. Important in the production of small parts when vertical milling is desirable.

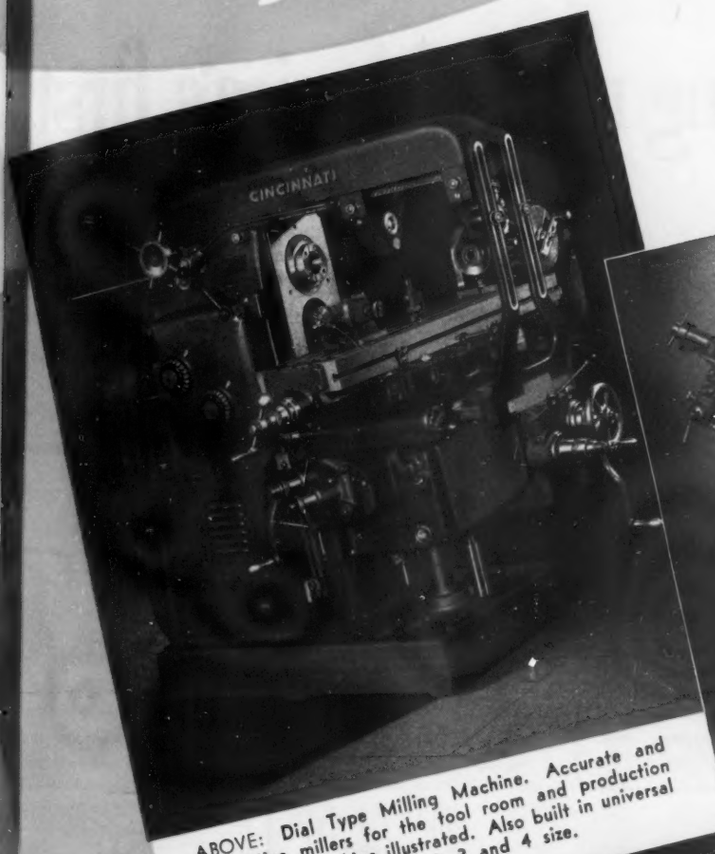
ABOVE: No. 1-12 Plain Automatic Milling Machine. For shops where high production of small parts is an important factor. Also built in No. 1-18 size.

THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING

Requirements OF TODAY

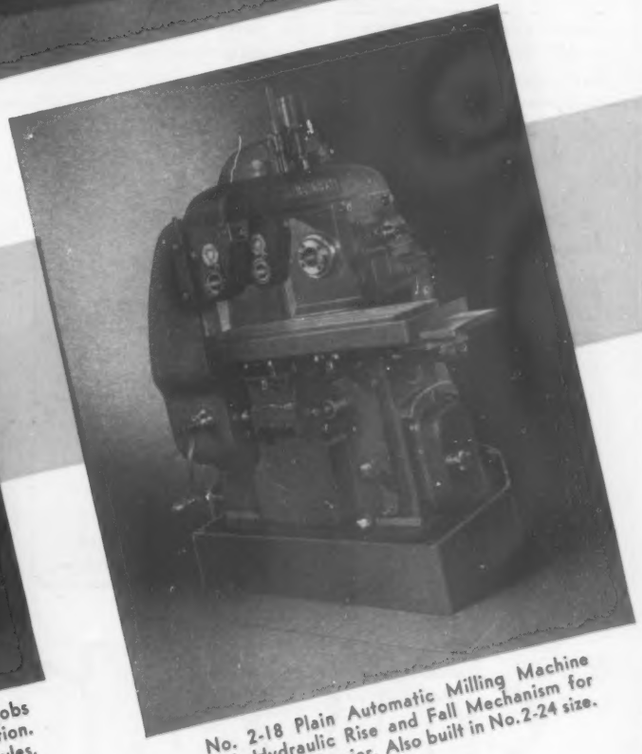
PATENT NOTICE — The machines illustrated and described on these pages are manufactured under and protected by issued and pending United States and Foreign Patents.



ABOVE: Dial Type Milling Machine. Accurate and productive millers for the tool room and production shop. Plain machine illustrated. Also built in universal and vertical styles, Nos. 2, 3 and 4 size.

LEFT: No. 2. Centreless Grinding Machine. Slashes grinding costs on a host of parts; steel, rubber, plastics, glass, etc. Economical for rather small lots, too.

Plain Hydromatic Milling Machine. For the heavy jobs run in medium or large quantity production. Made in plain and duplex styles, 18 sizes of each.



No. 2-18 Plain Automatic Milling Machine with Hydraulic Rise and Fall Mechanism for the Spindle Carrier. Also built in No. 2-24 size.

CINCINNATI GRINDERS INCORPORATED CINCINNATI OHIO, U.S.A.

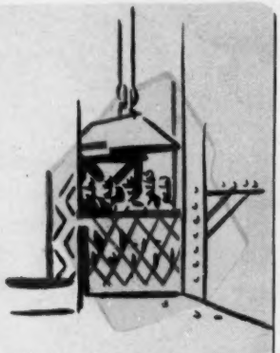
MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

Wire went to work

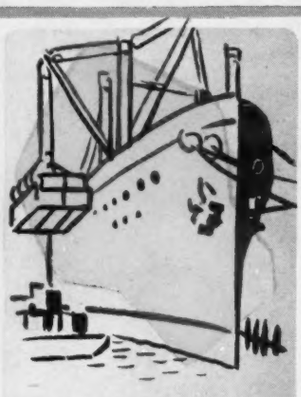
when John A. Roebling made America's first wi

ELEVATOR ROPES
for applications ranging from private residence "lifts" to high speed skyscraper elevators.

AERIAL TRAMWAYS
for passengers, freight, etc., including Patented Constam Ski-lifts illustrated above



MINING ROPES
for shaft elevators, steam shovels, drag scrapers, and other purposes.



MARINE ROPES
mooring lines, hawsers, hoisting rope, rigging, etc.

CONTROL CORD
for aeroplanes. Also gu- wire, strand, fittings, an electric wire and cable.

SHOVEL ROPES
wire ropes for excavating equipment, cranes, hoists, and other rope-rigged machinery.

OIL FIELD LINES
for rotary and cable tool drilling and every other oil field use.

STRIP STEEL
cold rolled high carbon "flats" for unending uses from steel measuring tapes to corset stays.

WOVEN WIRE FABRICS
from window screens to fine metallic filter cloth or coarsest mesh sizing screens.

MAGNET WIRE
for electric motor, gener- ator, and coil windings Insulations for every need.

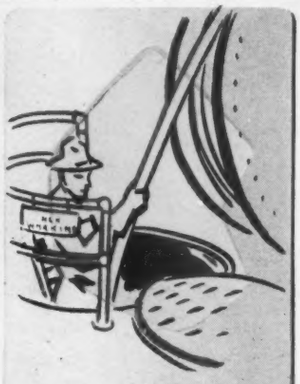
1841 FORWARD MARCH

WIRE ROPE AND STRAND,— Preformed and Standard ....
FITTINGS...SUSPENSION BRIDGES AND CABLES...AERIAL WIRE ROPE
SYSTEMS...COLD ROLLED STRIP...ELECTRICAL WIRES AND CABLES

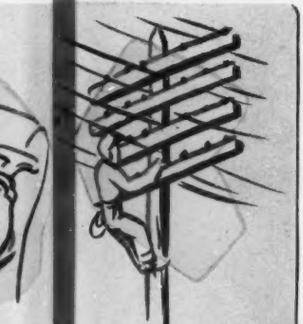
k for mankind

rst wire rope - 100 years ago!

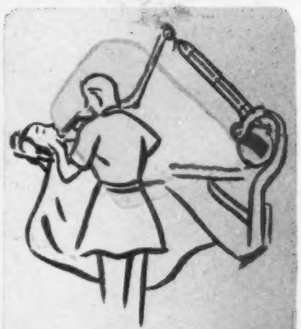
LAT WIRE
old rolled high carbon
teel flat wire for shoe
hanks, clocksprings,
eddles, etc.



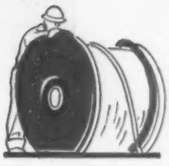
ELECTRIC CABLES
over 60 types of electric wires and cables for every purpose.



ELEPHONE WIRE
are galvanized, switch-
oard cable, twisted pair
nd parallel, etc.



DRAWN and ROLLED SHAPES
high or low carbon, for many uses including flexible shaft casings of dental equipment, miniature railroad tracks, etc.



Over 100 years ago John A. Roebling made America's first wire rope. Wire alone had been a useful but feeble servant of mankind. But, now, wire really went to work!

The first Roebling Wire Rope was used for hauling Pennsylvania Canal Boats up the Portage Railway. Then, came Roebling Cableways, installed in many countries to transport construction materials across streams and gorges—followed by the first suspension aqueduct for the old Pennsylvania Canal.

John A. Roebling's first wire rope has made possible many of our modern industrial and commercial achievements . . . great suspension bridges from coast to coast, from the "George Washington" between New York and New Jersey to the "Golden Gate" Suspension Bridge in San Francisco —high speed elevators for skyscrapers—oil well drilling—mechanized mining—modern highway building—and other accomplishments too numerous to mention.

Today, Roebling's "Forward March with Wire" encompasses not only wire rope but a great variety of other Roebling Wire Products including, in part, Electric Wires and Cables, Woven Wire Fabrics, Welding Wire, Cold Rolled Steel Flat Wire, and many others.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

Branches in principal cities

Export Division: 19 Rector Street, New York, N.Y., U. S. A. Cable Address: "Roebling's" New York

1941

CH WITH WIRE

WELDING WIRE . . . ROUND AND SHAPED WIRE . . . WIRE FORMS
WIRE CLOTH AND NETTING . . . STEEL AND COPPER RODS
HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS

Again it's

We are now building

THE WORLD'S LARGEST

FORGING MACHINE

A 9 inch—over 500,000 lbs.

This huge machine is being built for PRECISION FORGING and will possess all the superior features of other NATIONAL HIGH DUTY FORGING MACHINES

NATIONAL
MACHINERY COMPANY
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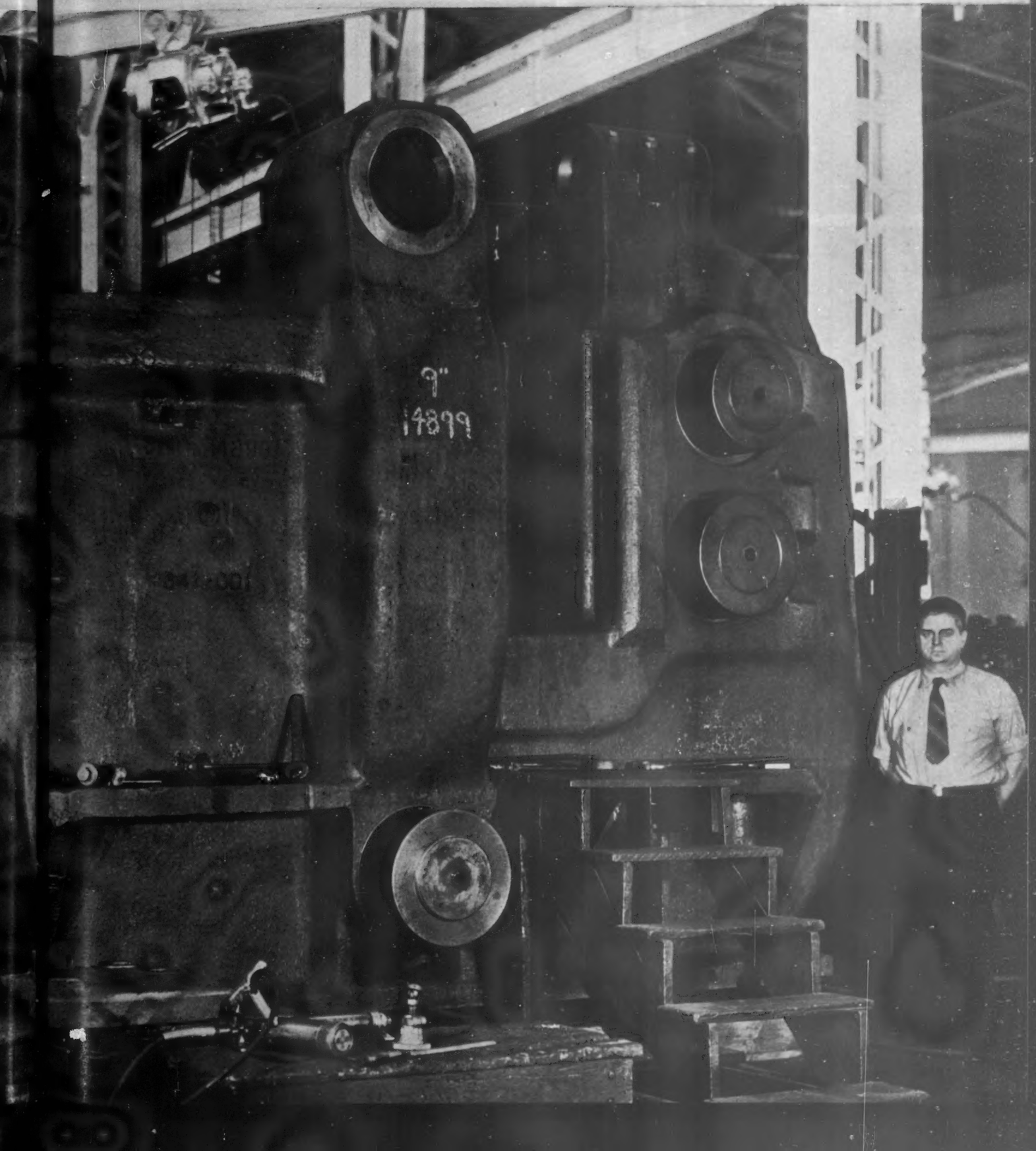
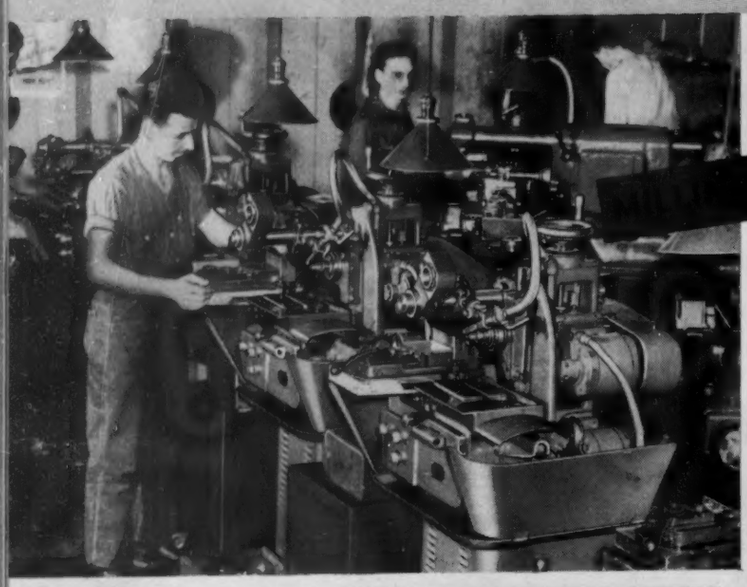
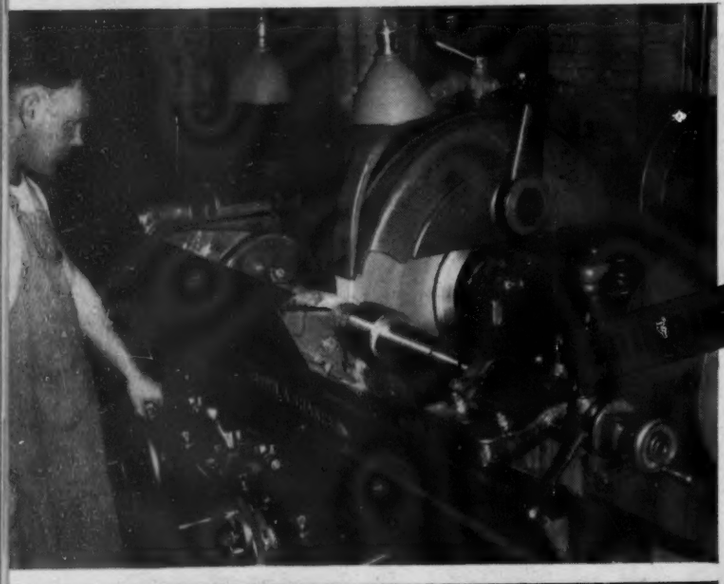
New York Detroit Chicago

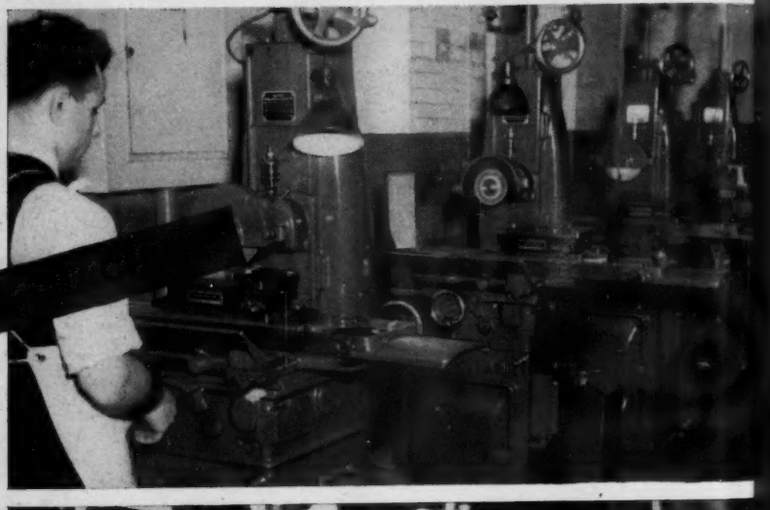
a National

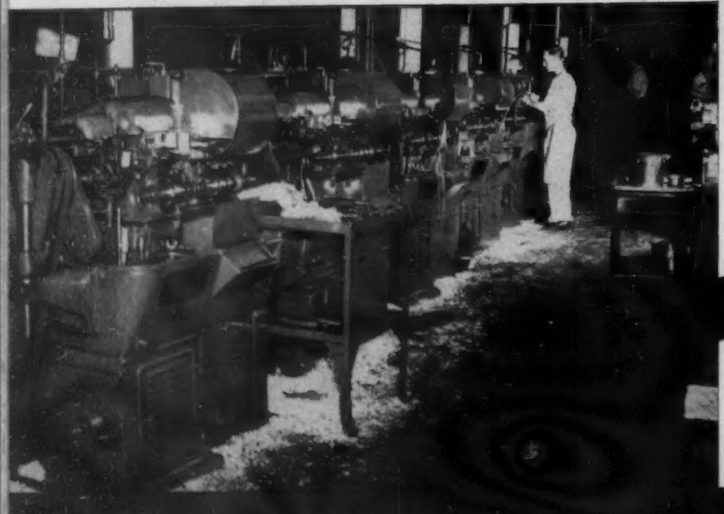


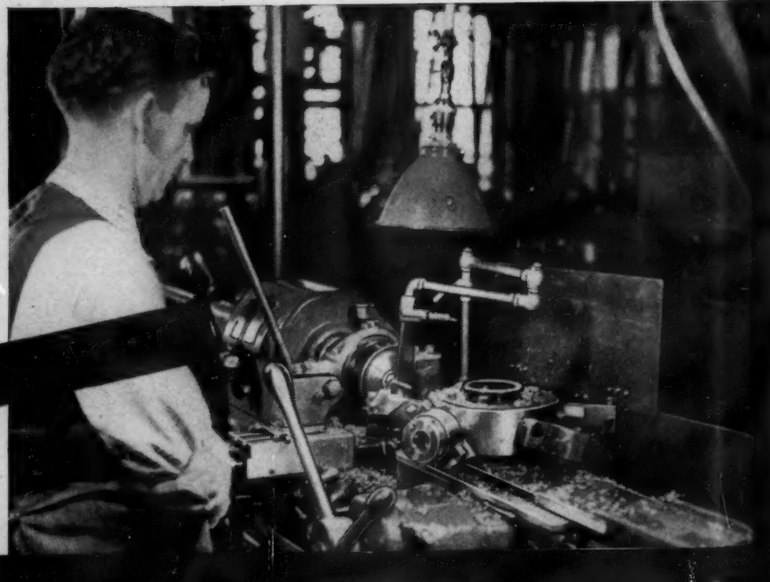
INCREASED PRODUCTION — HIGHER











BROWN &

QUALITY — LOWERED COSTS . . .

Milling Machines — A wide choice for toolroom as well as production use.

Universal — Omniversal — Plain — Manufacturing — Vertical — Attachments

Grinding Machines — For precision work, large and small.

Universal — Plain — Surface — Tool — Attachments

Screw Machines — Efficient types for long or short runs.

Automatic — Wire Feed — Attachments

Catalog describing the complete line gladly sent on request. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

— And in expanding your production, obtain auxiliary equipment which will give the greatest return in productivity and accuracy

— Specify Brown & Sharpe —

MACHINISTS' TOOLS — CUTTERS AND HOBS ARBORS AND ADAPTERS — MAGNETIC CHUCKS VISES AND PUMPS — OTHER SHOP EQUIPMENT

& SHARPE

Thru 1941 • Machine Tools • T

in THREADING it's

LANDIS *for assured*

ACCURACY • ECONOMY • PRODUCTION

LANDIS THREAD CUTTING MACHINES, DIE HEADS and COLLAPSIBLE TAPS are recognized universally for their ability to produce threads of the finest accuracy at the lowest possible Threading Cost.

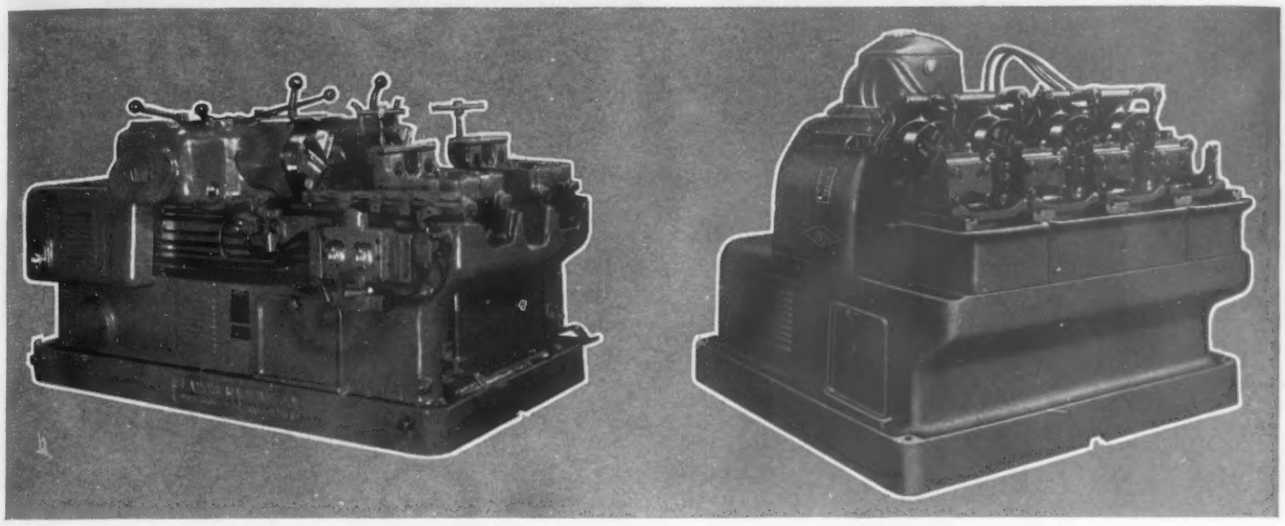
Through 1941 as our Defense Program reaches its peak you cannot do better than to depend on LANDIS to expedite your thread cutting operations in the most efficient and economical manner.

LANDIS THREAD CUTTING MACHINES *plus* . .

THE LANDIS AUTOMATIC FORMING & THREADING MACHINE

THE LANDMACO THREADING MACHINE

The Key to National Defense



THE LANHYDRO (HYDRAULICALLY CONTROLLED) TURNING & THREADING

SEMI-AUTOMATIC THREADING MACHINE

. . . the complete line of LANDMATIC, LANCO, and LANDEX Die Heads—for all kinds of external threading operations—and, LANDIS Collapsible Taps, for Internal Threading—provides a complete THREAD CUTTING service. A service which assures greater PRODUCTION — finer ACCURACY and Increased PROFITS.

***THROUGH 1941 BUY* LANDIS**

The LANDIS *Line*

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

LANDIS MACHINE COMPANY Inc. Waynesboro Pennsylvania

WE BUY PLANTS

An idle plant is a headache. We liquidate by outright purchase or on a partnership plan, your equipment, materials, buildings and land. At one stroke we can cure your headache, liquidate your idle property, and enable you to take advantage of the 1941 income tax law. This provides that you may deduct from your gross income full loss on liquidation of capital equipment.

WE SELL PLANTS

Because we don't buy plants to use ourselves, we sell them in several ways. We may renovate them, reconstruct them, or just sell them outright at whatever profit we may get that is commensurate with the risk. When you place your idle plant in our hands, we can get rid of it; if you are looking for a good plant, we can sell you one.

WE TEAR 'EM DOWN

When you want to dispose of buildings but retain the land, we raze buildings to the ground, reducing them to salable scrap. Our methods are thorough, our experience is ample. By this complete liquidation, all owner's expense is stopped; he may then reinvest his recovered funds in something else. Confidential inspections and proposals without obligation.

WE CUT 'EM UP

Part of our business consists in cutting up idle plants into serviceable units. When a plant is too large to operate profitably for one, we divide it into as many units as are necessary or practical; in this way, a number of individual manufacturers may enjoy locational and transportation facilities formerly enjoyed by one large company.

Our business is extensive and comprehensive. In the matter of dismantling, we offer several attractive deals: we will buy outright, make a flat guarantee and share the profits, remodel, or suggest a re-melting deal. Our liquidation service includes equipment, materials, buildings and land. If you want to buy or sell, decrease your holdings or liquidate entirely, investigate our offer.

HETZ CONSTRUCTION CO., INC.

GRISWOLD STREET N. E. • WARREN, OHIO

Complete NORTON GRINDING SERVICE

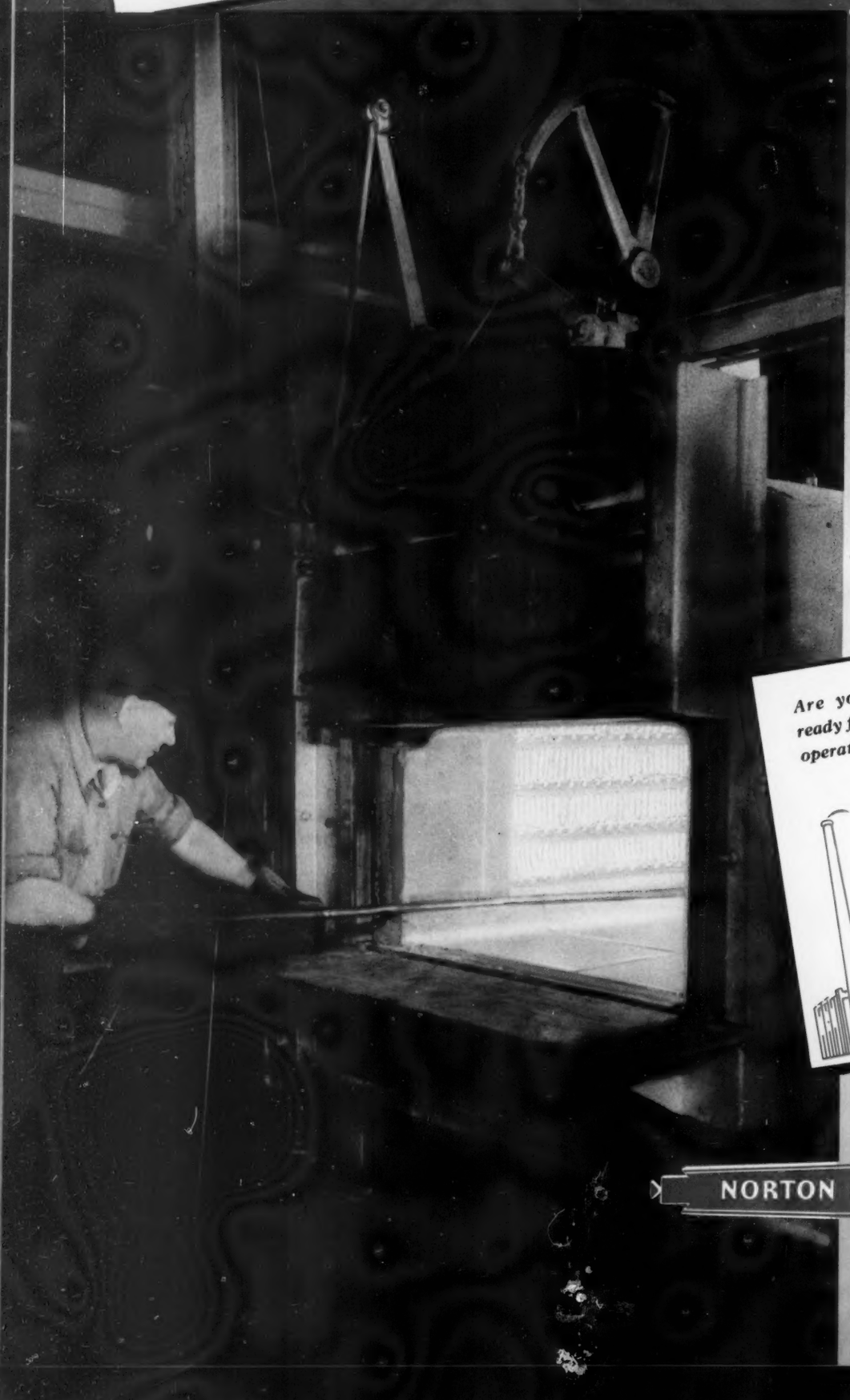
FROM the Norton laboratories have come special Resinoid Bonded Grinding Wheels for various types of work—such as snagging, billet grinding, weld finishing, cutting off, disc grinding, roll grinding. And Norton engineers the country over are ready to insure their correct application on your grinding operations.

It is a typical example of the complete Norton Service embracing research, engineering, manufacture and distribution.

NORTON COMPANY
Worcester, Massachusetts

NORTON ABRASIVES

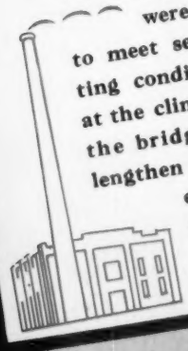
Norton Service for handling heat



TYPICAL of the Norton refractory products that are enabling industry to handle heat more effectively are Crystolon Hearth Plates for heat treating furnaces. Their features are high refractoriness, high strength, high heat conductivity, resistance to spalling and to abrasion. And they are characteristic features of the complete line of Norton heavy duty refractory products—cements, bricks, muffles and other shapes.

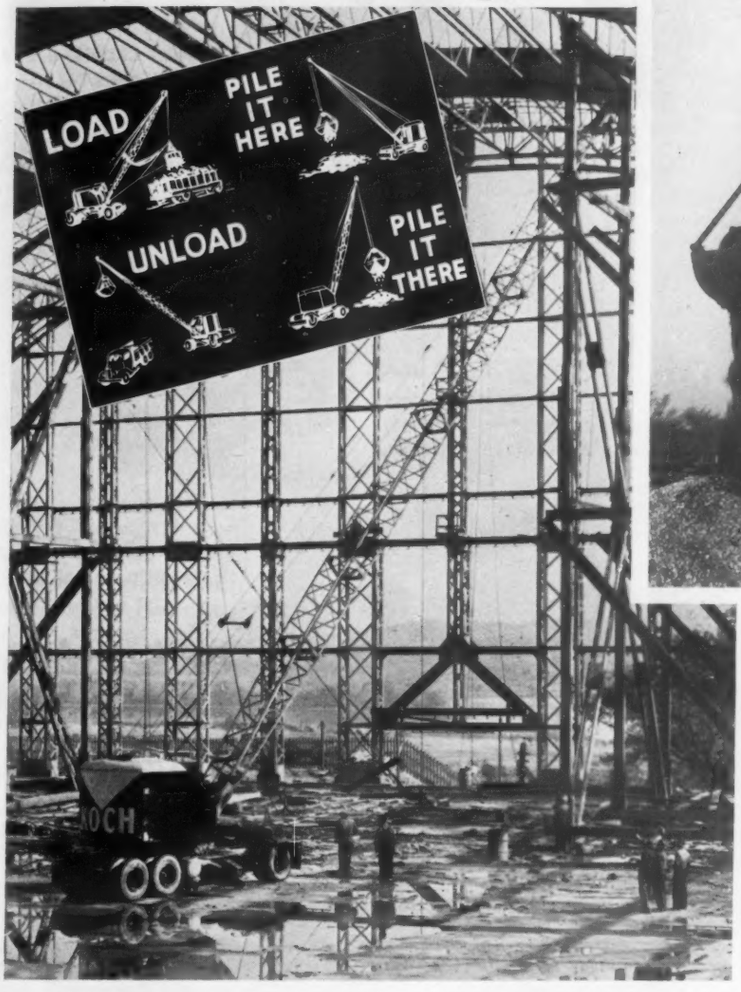
Are your boiler furnaces ready for uninterrupted peak operation?

Crystolon Brick were developed to meet severe operating conditions. Used at the clinker line and the bridge wall they lengthen the life of the entire boiler furnace lining.



NORTON REFRACTORIES

Here it is! MOBILITY
TO GET THAT
MATERIAL HANDLED
Quicker and Cheaper



SELF PROPELLED
ONE MAN OPERATED
ONE ENGINE POWERED
FASTER · SMOOTHER
LOWER OPERATING COST

GO WHERE YOU WANT TO GO . . .
WITHOUT TRACKS OR OVERHEAD RAILS

GENERAL *Super-crane*

OSGOOD *Mobil-crane*

☐ The OSGOOD Company
☐ The GENERAL Excavator Co.
} MARION OHIO

Your New ONE MAN PNEUMATIC TIRED CRANES interest me. Tell me—without obligation—more about them.

Name _____ Title _____

Firm _____

Street _____

City _____ State _____

S

Let's PROFIT BY . . .

AS OUR DEFENSE PROGRAM gains momentum, more and more buyers appreciate the advantages of a source where equipment for top speed mass production has been *thought out and proved out* far in advance of their needs.

The losses in time and in output that result from trial and error methods of tooling-up are too costly. And any machine or tool that fails to stand the gaff on a 24-hour line of action is a further liability against your profit in the job.

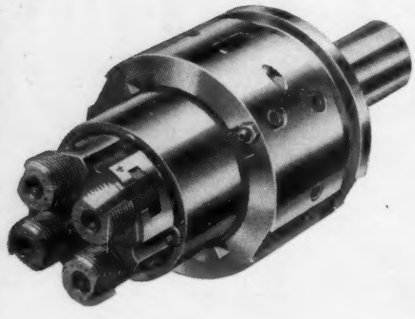
Seven types of National Acme products are here illustrated. Some are complete high production units; others are important auxiliaries to the equipment you now own. None is in any sense experimental.

Literally thousands of the threading tools, oil reconditioning centrifuges, bar automatics and Electrical Mfg. Division products are already engaged in Army, Navy and Aircraft production for defense.

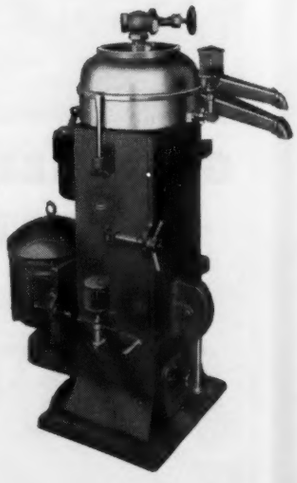
The broad experience we have gained from adapting these products to both common and highly special uses is yours upon request. This ready-made experience will cost you no more—maybe less. Profit by it.

NAMCO CIRCULAR CHASER SELF OPENING DIES—favored for production threading. By a simple change they are converted to hollow milling heads—double duty tools—.056" to 4⅞" capacities. Catalog D-38.

Circular chasers minimize scrap loss, save time between grinds—multiply chaser life 10 to 20 times.



NAMCO COLLAPSING TAPS—quick and positive operating. Equipped with ground thread circular chasers will positively hold size on long run high precision jobs. Other styles cover capacity range 1" to 13⅜". Catalog D-38.



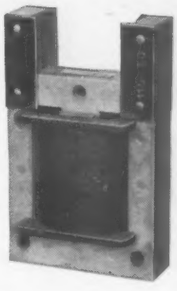
POSITIVE CENTRIFUGE—for oil reconditioning, quickly pays for itself in any production shop where attention is given to oil saving and life of machines and tools. Catalog P-41.

Write for general descriptive information. Or, better still, ask that a sales engineer call to discuss your particular needs.

Ready-Made Experience

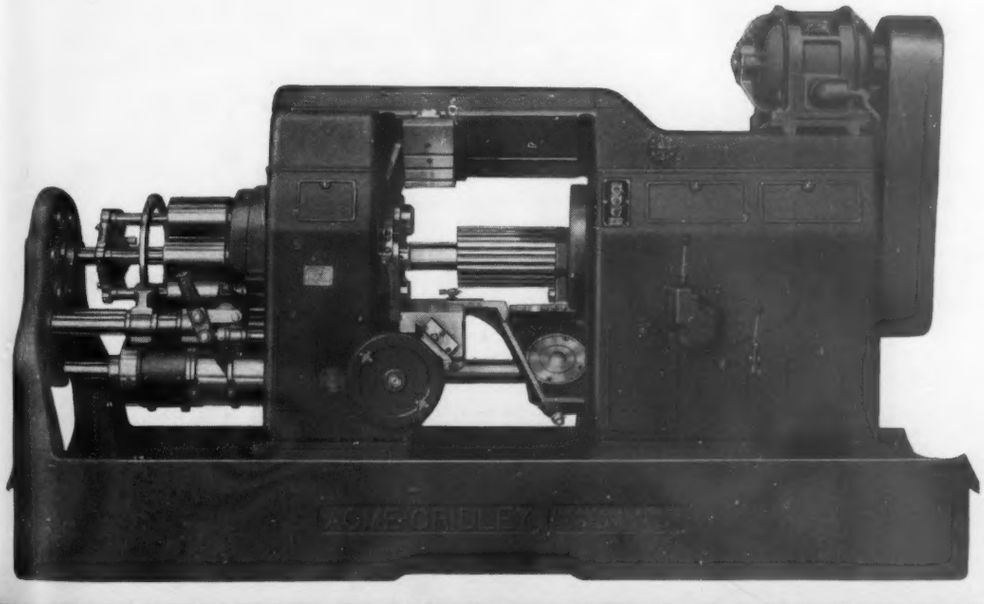
THE CHRONOLOG—prints a record showing why, when and how long any production operation is idle. Gives accumulated count of units produced. Coordinates operations and shows production increases averaging more than 10%. Catalog No. 3707.

SOLENOIDS—designed to meet the heavy duty "stay-put" requirements of machine tool manufacturers. Hardened contact surfaces overcome plunger wear. Less weight, smaller size and higher pull at less amperage. Feet or plate mountings to suit. 4 to 30 lbs. at 1" stroke push or pull.



ELECTRIC COUNTER—with simplified construction—dependable solenoids, working parts of hardened steel, dust proof, legible dial. Rugged throughout, guaranteed electrically and mechanically accurate for life of heavy duty machines at high speed on continuous production.

SNAP-LOCK LIMIT SWITCH—for all normal circuit duty, features 2 double break circuits, separate enclosures for electrical and mechanical sides. Levers to suit. Adopted by over 200 manufacturers as standard built-in switch, used by thousands of others for replacement. "Built with machine tool ruggedness." Free trial.



NEW MODEL RA ACME-GRIDLEY MULTIPLE SPINDLE BAR AUTOMATICS—hundreds of them are engaged in every kind of munitions and commercial work requiring mass output with high precision.

"SUSTAINED ACCURACY... at the fastest feeds and highest spindle speeds that modern cutting tools can safely stand."

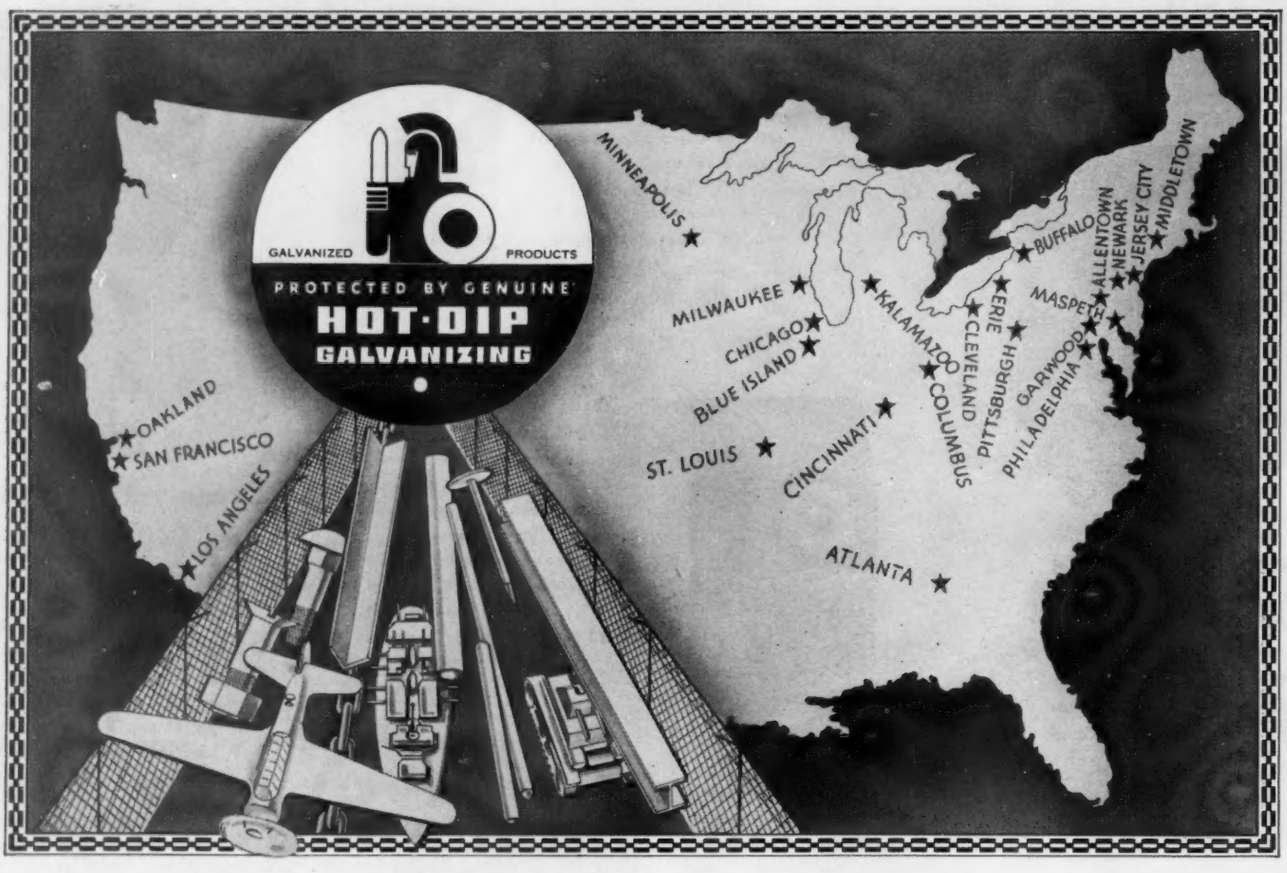
NATIONAL ACME

170 EAST 131ST STREET • CLEVELAND, O.

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

AMERICAN HOT DIP Galvanizers Association

STRATEGICALLY LOCATED WITH REFERENCE TO STEEL



WHEREVER THERE'S A NEED . . . THERE'S A MEMBER

Rigidly *adhering* to the highest standards of quality at reasonable prices, *maintaining* the most modern and completely equipped shops, *employing* expertly trained personnel, *enjoying* the constant help of an efficient research department, this association represents *the* pioneering, stabilizing anchor of the galvanizing world . . . It is *your guarantee* of getting good work quickly and a genuine Hot Dip Job every time . . . Why gamble—deal with a *known* quality — patronize our very conveniently located members. WE ARE ORGANIZED FOR HIGH SPEED, EFFICIENT PRODUCTION. American Hot Dip Galvanizers Association, Inc., American Bank Bldg., Pittsburgh, Pennsylvania.

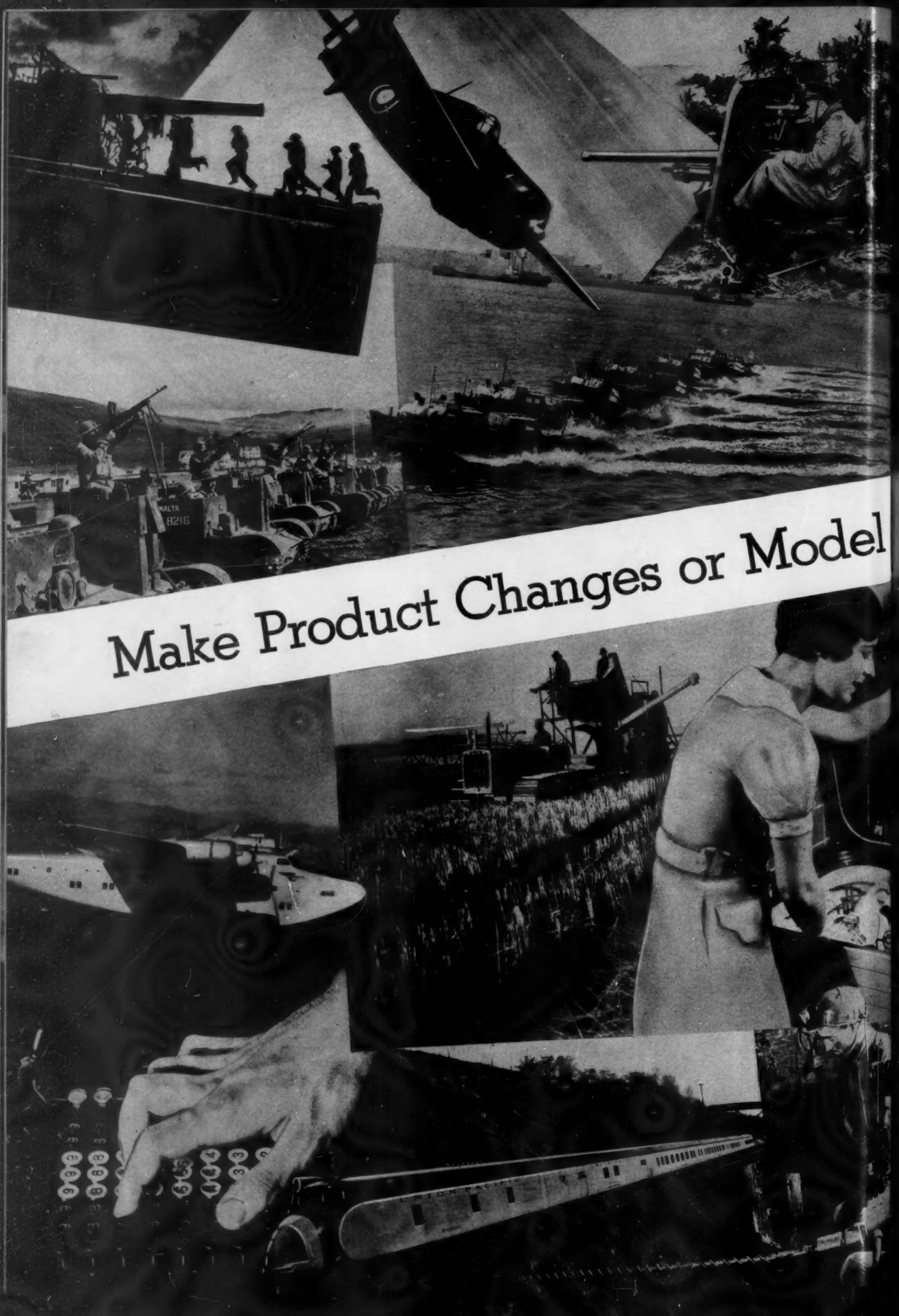
IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

Know the truth about Galvanizing. Write for official specification sheet and new folder giving actual data on life of Hot Dip Galvanized Products under various conditions.

Acme Galvanizing, Inc., Milwaukee, Wis. ★ Acme Steel & Malleable Iron Works, Buffalo, N. Y. ★ American Tinning & Galvanizing Co., Erie, Pa. ★ Atlantic Steel Co., Atlanta, Georgia ★ Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N.Y. ★ Diamond Expansion Bolt Co., Inc., Garwood, N.J. ★ Equipment Steel Products Division of Union Asbestos and Rubber Co., Blue Island, Ill. ★ The Fanner Mfg. Company, Cleveland, Ohio ★ John Finn Metal Works, San Francisco, Cal. ★ Thomas Gregory Galvanizing Works, Maspeth, N.Y. ★ Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa. ★ Hubbard & Co., Oakland, Cal. ★ Independent Galvanizing Co., Newark, N.J. ★ International-Stacey Corp., Columbus, Ohio ★ Isaacson Iron Works, Seattle, Wash. ★ Joslyn Co. of California, Los Angeles, Cal. ★ Joslyn Mfg. & Supply Co., Chicago, Ill. ★ L. O. Koven & Brother, Inc., Jersey City, N. J. ★ Lehigh Structural Steel Co., Allentown, Pa. ★ Lewis Bolt & Nut Co., Minneapolis, Minn. ★ Missouri Rolling Mill Corp., St. Louis, Mo. ★ The National Telephone Supply Co., Cleveland, Ohio ★ Penn Galvanizing Co., Philadelphia, Pa. ★ Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. ★ San Francisco Galvanizing Works, San Francisco, Cal. ★ The Sanitary Tinning Company, Cleveland, O. ★ Standard Galvanizing Co., Chicago, Ill. ★ Wilcox, Crittenden & Company, Inc., Middletown, Conn. ★ The Witt Cornice Company, Cincinnati, O.

TIME PASSES; QUALITY REMAINS

BOWER
ROLLER BEARING CO.
Detroit, Michigan


Make Product Changes or Model

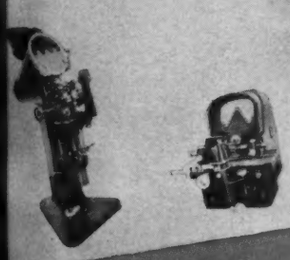
FAY AUTOMATIC LATHES GIVE FULL ADVANTAGE OF MULTIPLE TOOLING AND COMBINED CUTS

el Changes Quicker at less cost

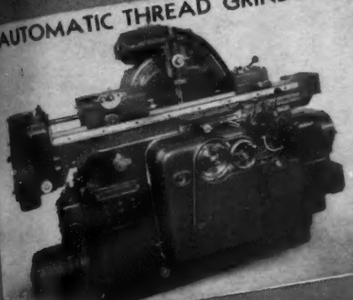
WITH JONES & LAMSON STANDARD EQUIPMENT

Because the American public has learned to demand newer and finer models in everything from autos to vacuum cleaners with each new year, American manufacturers have learned to use a minimum of special machinery. Experience shows that versatile, adaptable Jones & Lamson Standard Universal Turret Lathes, Fay Automatic Lathes, Comparators, Automatic Thread Grinding Machines and Automatic Opening Die Heads can be changed rapidly from job to job or model to model while special machines can only be discarded. In adapting your plant to defense work today or to profitable manufacturing in future years, Jones & Lamson equipment helps you both ways. That's why it pays to put your production problems up to Jones & Lamson engineers.

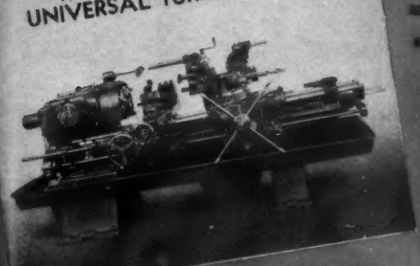
OPTICAL COMPARATORS



AUTOMATIC THREAD GRINDERS



RAM & SADDLE TYPE UNIVERSAL TURRET LATHES



AUTOMATIC OPENING DIE HEADS

JONES & LAMSON

MACHINE COMPANY

Springfield, Vermont, U.S.A.

MANUFACTURERS OF SADDLE & RAM TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . TANGENT AND RADIAL, STATIONARY AND REVOLVING DIES AND CHASERS

PROFIT PRODUCING MACHINE TOOLS

Whitey Sez:

"The funny thing about speculation is that a thousand dollar paper profit looks like a trifle, whereas a thousand dollar cash loss will drive a man to drink... Speculation on MAURATH *Rods is bound to be stainless."*

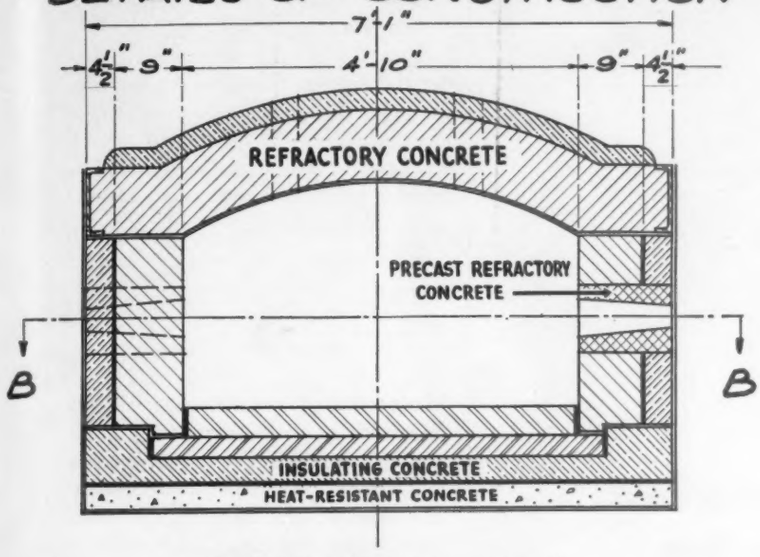
MAURATH, INC., CLEVELAND

BUILDER OF BETTER WELDING ELECTRODES IN ALL ANALYSES

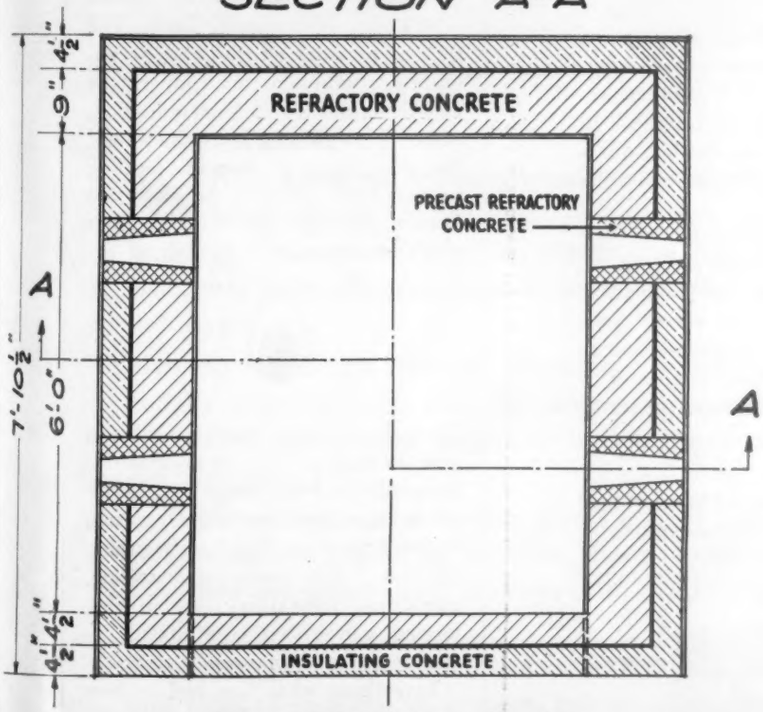
How they built this furnace with 3 KINDS OF CONCRETE

The Dominion Bridge Co., Ltd., of Lachine, Quebec, did a complete job in this furnace with Refractory Concrete, Insulating Concrete and Heat-Resistant Concrete—all made with LUMNITE

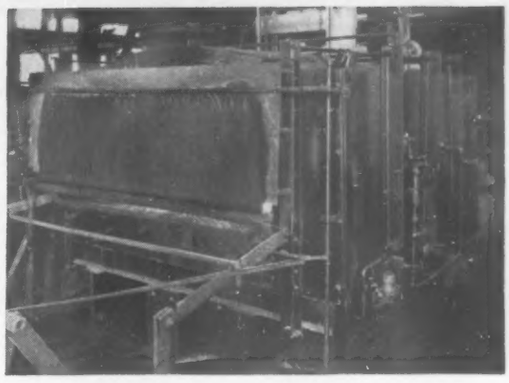
RIVET ROD HEATING FURNACE
DETAILS OF CONSTRUCTION



SECTION A-A



SECTION B-B



ADAPTABILITY to a variety of high temperature conditions led to the use of three kinds of LUMNITE concrete in building this rivet-rod heating furnace.

- **Refractory Concrete construction eliminated joints, cut down air infiltration, thereby reducing scaling to a minimum and saving heat.**
- **Insulating Concrete back-up, sub-floor and roof cover further reduced heat loss and smoothed out temperature control.**
- **Heat-Resistant Concrete formed a level, monolithic bottom slab.**

All three concretes—Refractory, Insulating and Heat-Resistant—were made with LUMNITE, a cold-setting, rapid-hardening binder. Cast-in-place Refractory Concrete and Insulating Concrete form the bottom, walls and roof arch. Burner ports are precast Refractory Concrete units.

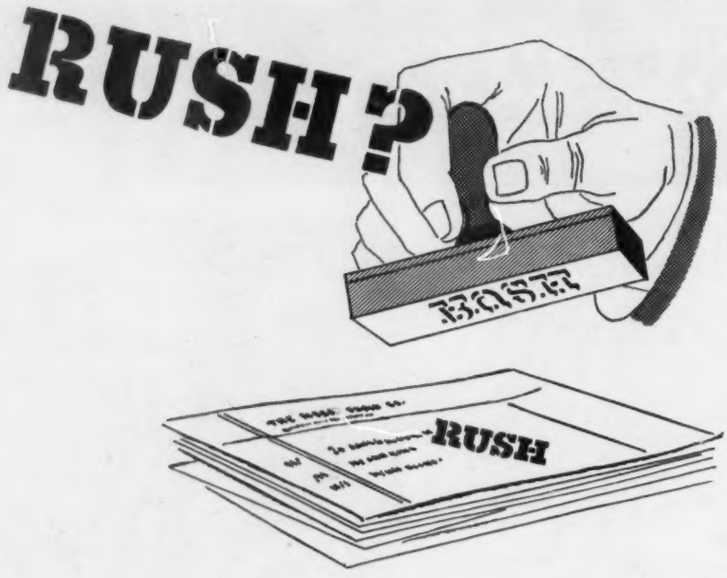
The desired refractory and insulating properties of each kind of concrete are determined by the type of aggregate. LUMNITE is the binder holding the aggregate together to form concrete which will stand up at high temperatures. The Dominion Bridge Company used crushed fire brick and LUMNITE for the Refractory Concrete, a lightweight insulating aggregate and LUMNITE for the Insulating Concrete.

Keep LUMNITE in stock. With a supply of inexpensive aggregates you will have material on hand for a great variety of refractory installations—and for speedy repairs.

For detailed information, write for booklet, "Refractory Concrete." Address Atlas LUMNITE Cement Co. (United States Steel Corporation Subsidiary), Dept. S-10, Chrysler Building, New York City.

LUMNITE FOR REFRACTORY CONCRETE

Are all your orders marked



Here's how modern GAS equipment can speed up your production

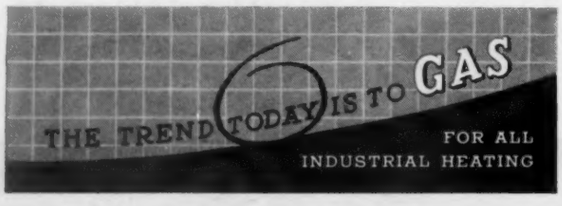
As American Industry mobilizes for defense the one insistent cry is for faster and faster production. Output must be stepped up—and rapidly! Quality must be maintained—and improved! Costs, wherever possible, must be reduced!

Today the gas industry meets this challenge with a quick heating, accurately controllable, economical fuel, and industrial gas equipment of advanced design—a combination which in thousands of plants is speeding up production, maintaining and improving quality, and cutting costs in the bargain.

Up-to-date Gas installations provide speed, efficiency, and economy that go far beyond anything that industry has ever known before. Gas is particularly well suited to precision manufacture because it is so accurately controllable both as to temperature and furnace atmosphere. In addition, it is clean, flexible, quick heating, and of all fuels highest in utilization value.

To speed up production in your plant, investigate what Gas can do. Your gas company will be glad to consult with you—to survey your industrial heating problems—and to show you how other companies in your line are using Gas profitably and economically.

AMERICAN GAS ASSOCIATION
INDUSTRIAL and COMMERCIAL
GAS SECTION
420 LEXINGTON AVE., NEW YORK CITY



IT PAYS to use modern GAS equipment

Among the interesting Gas-fired installations which are saving money and making profits are the insulated steel encased ingot and billet heating furnaces in the plant of the **Columbia Tool Steel Company,** Chicago Heights, Ill. A special feature of these furnaces is that they can be, and in one instance have been raised with jacks and put on rollers and moved to a new location.

Results? Added improvement in material processed, longer furnace life, and reduced repairs to refractories; a decided reduction in scale and surface decarburization, and therefore a greater net return per pound of material processed.

Modern Gas equipment—especially today, with heavier demands for speed and efficiency—is setting new records for speed of production and economy of operation. For instance, the open-fired bright annealing Gas furnace in the plant of the **Mueller Brass Company,** Port Huron, Mich. The furnace provides an ideal bright annealing atmosphere for copper; the annealed tube is free from oxidation, therefore no pickling is required—and the plant saves an average pickling cost of $1.22 per ton. Actually, the furnace paid for itself with the first year's operation.

Through the whole metals field you hear the same story—a story of newly-designed Gas-fired equipment, better products, reduced time cycles for firing, further economies. For there's nothing like Gas . . . for hardening, annealing, tempering, normalizing, carburizing, forging, galvanizing, core baking, nitriding or malleableizing.

Investigate what Gas and modern Gas equipment can do to improve production in your plant. You may find out some interesting things!

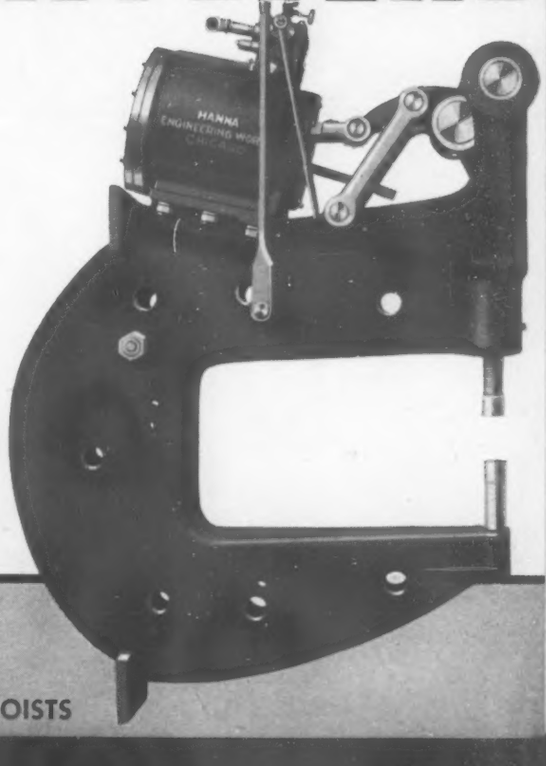
RIVETED JOINTS
For
SAFETY—DEPENDABILITY
In 1927
AMERICA'S LATEST
Indicates the continued do
The stress of weights and lo
and the shock of tremendo
Riveted Joints.
You will usually find one o
HANNA RIVETERS
"DRIVING RIVETS HOME"
Our engineers have successfully solved riveting
problems for years. Perhaps we can assist you—
there is no obligation for this service.
HANNA ENGINEERING WORKS
1765 ELSTON AVE., CHICAGO, U. S. A.
In 1927 this Hanna advertisement appeared in print. Its subject today is of vastly greater importance viewed in the light of present events
Again the way to build the Toughest Tanks the Quickest!
In 1940
with
Hanna
Squeeze
RIVETERS

WHEN American industry knuckles down to a problem — things happen fast! The job may be one of building tanks and trucks, or plows and tractors, but whatever it is, efficiency gets it done. That's American industry.

Riveting is efficient because it's simple and safe. That is why industry rivets and the reason so many Hanna Squeeze Riveters have helped in building and preserving America.

Each piston stroke of a Hanna drives a rivet — one that is tight, completely filling the hole. Every stroke delivers the same pre-determined tonnage with a controlled and positive squeeze.

What do you rivet? There are over 700 Hanna styles and sizes to squeeze your rivets hot or cold. Our forty years of riveting experience is yours to help you solve any problems.



HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO, ILLINOIS

Air and Hydraulic RIVETERS • Air and Hydraulic CYLINDERS • Air HOISTS

PRECISION AND SPEED

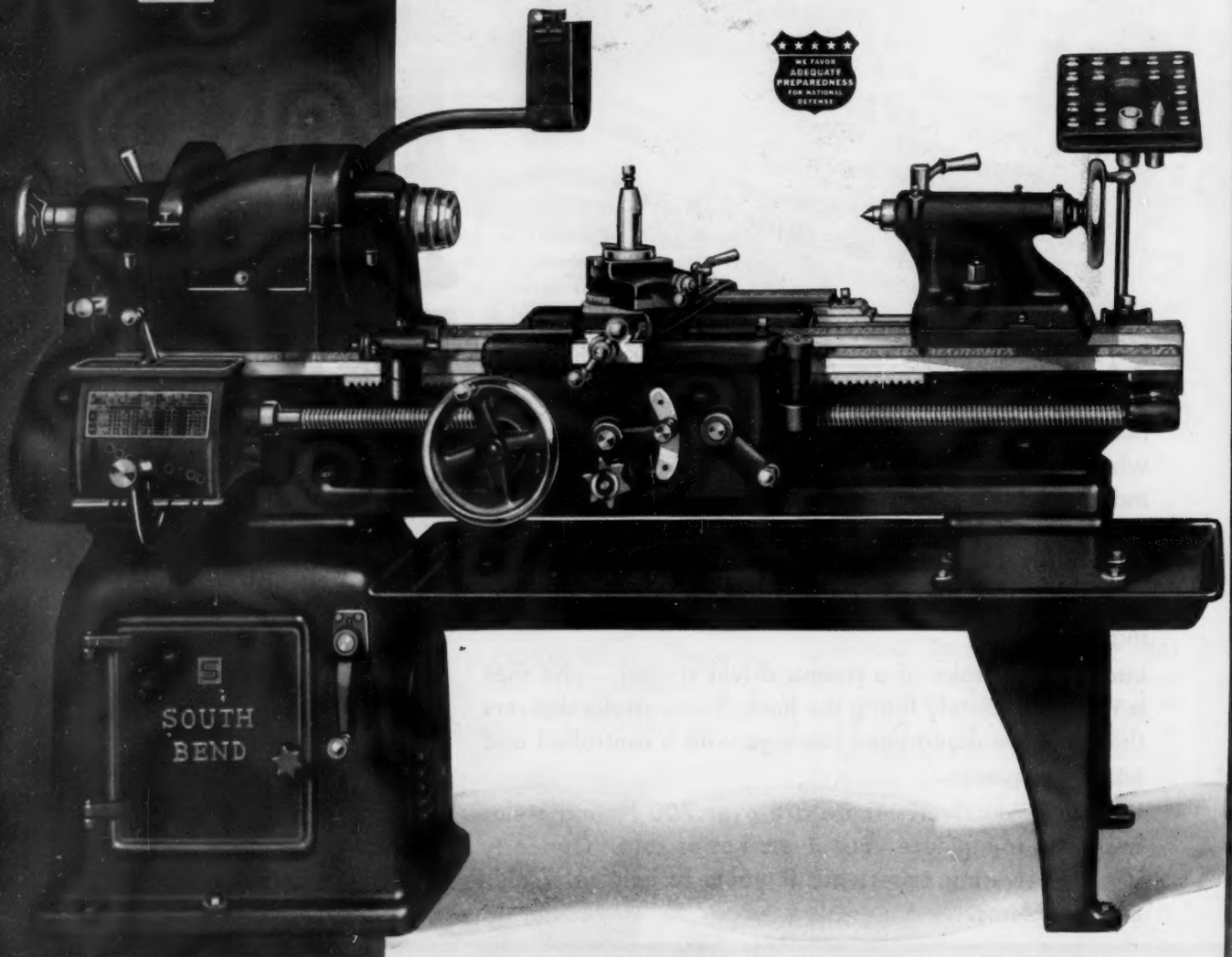
WITH SOUTH BEND LATHES

To make a profit, in these highly competitive times, machine operations must be performed quickly and accurately. High spindle speeds and extreme rigidity are essential for efficient machining with sintered carbide or diamond tipped tools, especially when finishing die castings, plastics and other fast cutting materials. Precision and speed are therefore important factors to consider when selecting a lathe.

South Bend Lathes have extreme precision and ample speed for turning out work efficiently and profitably. They are giving satisfactory service in the tool rooms and production shops of America's topmost industries.

Features responsible for the excellent performance of South Bend Lathes include an alloy steel spindle with hardened and superfinished bearing surfaces, a one-piece double wall apron with steel gears running in oil, a powerful worm drive and multiple disc friction clutch for operating the power carriage feeds, and a direct belt drive to the spindle.

South Bend Lathes are manufactured in five sizes, 9" to 16" swing. If you are considering the installation of a lathe, write for our new catalog describing the New Series "S" South Bend Lathe.



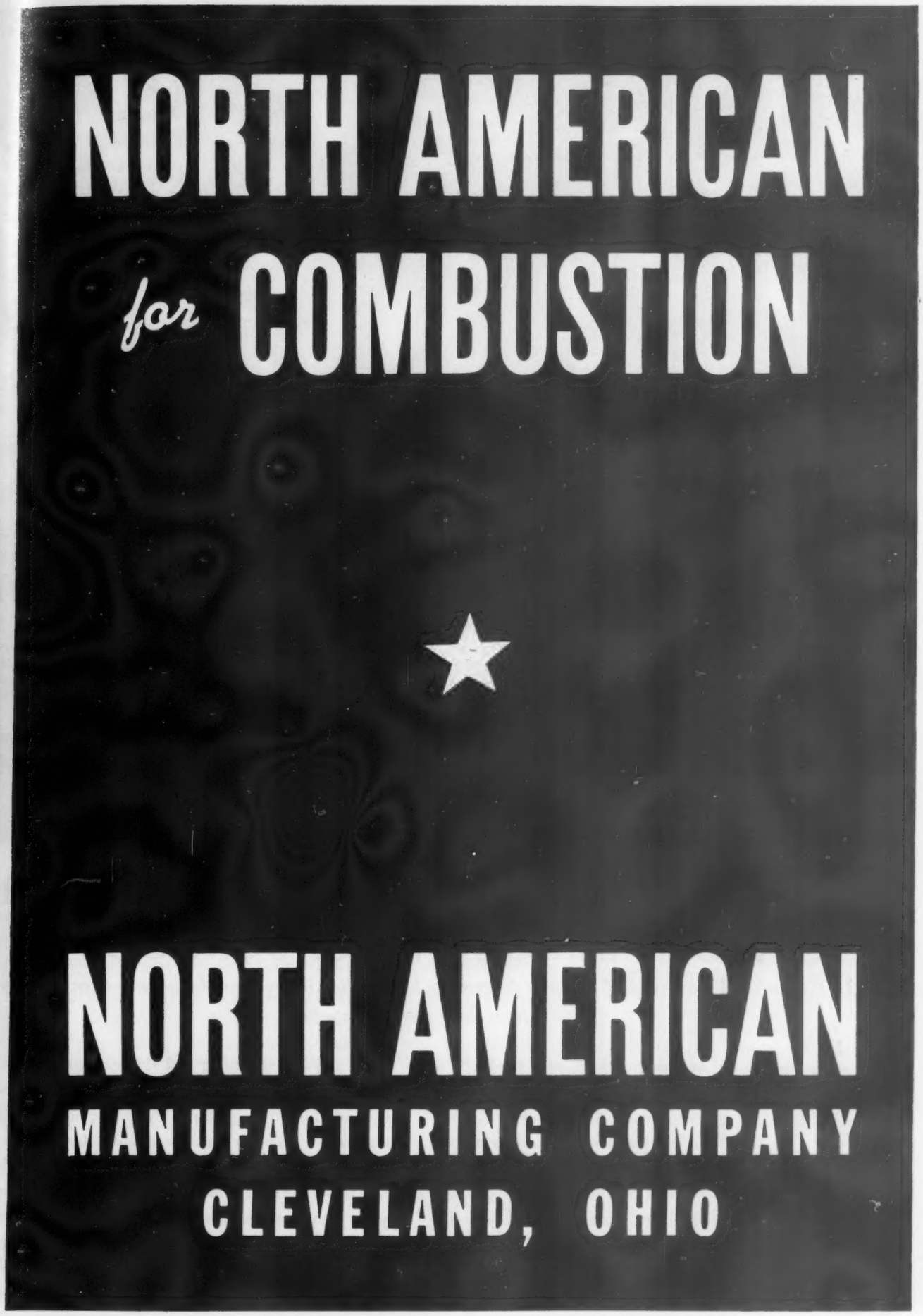
Lathe Builders Since 1906

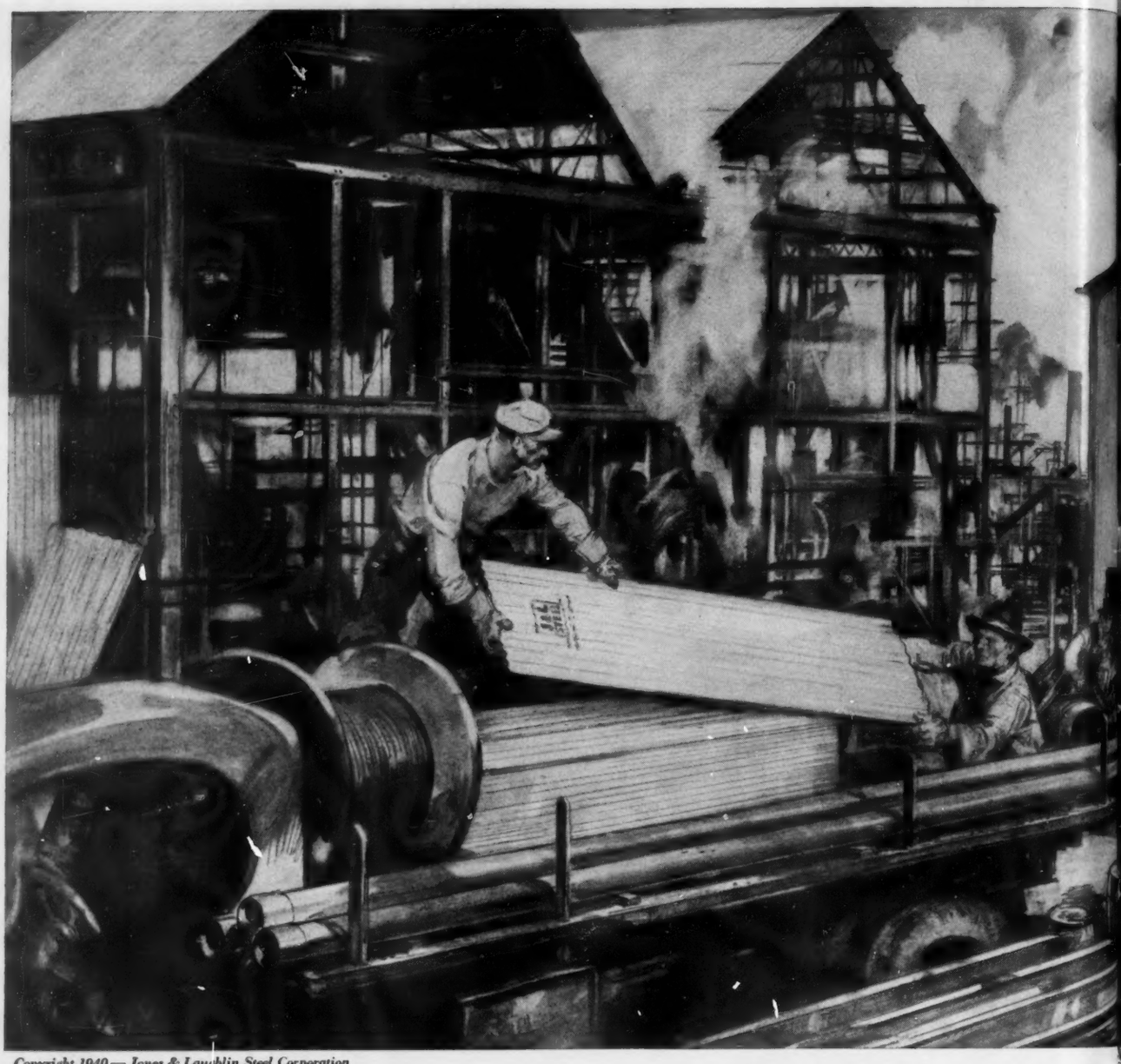
SOUTH BEND LATHE WORKS

654 East Madison Street, South Bend, Indiana

Boston Sales Office: 67 Broadway, Kendall Sq., Cambridge, Mass., Tel. Trowbridge 6569

Chicago Sales Office: Room 308, Machinery Sales Building, Telephone State 7283


NORTH AMERICAN
for COMBUSTION
NORTH AMERICAN
MANUFACTURING COMPANY
CLEVELAND, OHIO



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COMPLETE FACILITIES OF J&L STEEL MILLS RIGHT IN YOUR NEIGHBORHOOD

J & L Controlled Quality Steel products delivered to local industries by dependable home-town distributors from their extensive stocks.

"As a user of J & L steel products, it is a great help and satisfaction to me to receive, in these small lots, from two of your local J & L distributors, the same careful filling and handling of orders as when I buy steel in carload lots for direct shipment from your mills. One distributor is delivering an odd-lot of J & L Cold Finished steel bars to help us complete a hurry-up order for manufactured parts; the other is delivering the J & L pipe, nails, galvanized roofing and siding, wire rope, Junior Beams and Junior Channels we are using in making this addition to our plant. By this quick-to-respond service, we keep our customers happy by on-time production and our new building will be ready on schedule."

"It is a pleasure to me — a J & L man — to be here at your plant watching this follow-through of our service. Our works are geared to making J & L Controlled Quality Steel by the ton, but its practical application is often by the pound and by the foot. To make J & L steel products

"It is a great help to me to receive... in these small lots, from your local J&L distributors... the same careful filling of orders as when I buy steel in carload lots for direct shipment from your mills."

From an original drawing by Orison MacPherson

available everywhere in these quantities to more and more manufacturers like yourself, J & L is constantly expanding its nation-wide, next-door system of distribution. There is no group of steel jobbers more competent, more energetic, more pleasant to do business with, than those handling J & L steel products."

J&L DISTRIBUTORS SERVE AMERICAN INDUSTRY WITH THESE J&L CONTROLLED QUALITY STEEL PRODUCTS:

HOT ROLLED BARS • JUNIOR BEAMS • JUNIOR CHANNELS • JALCASE STEEL • COLD FINISHED ROUNDS, SQUARES, HEXAGONS, FLATS, SHAFTING • HOT ROLLED AND COLD ROLLED SHEETS • FLAT GALVANIZED SHEETS • GALVANIZED ROOFING AND SIDING • WELDED AND SEAMLESS STANDARD PIPE, LINE PIPE • OIL COUNTRY TUBULAR GOODS • HOT ROLLED SEAMLESS BOILER TUBES • BRIGHT, ANNEALED AND GALVANIZED WIRE • WOVEN FENCING • BARBED WIRE • FENCE STAPLES • NETTING STAPLES • BRIGHT, COATED AND GALVANIZED NAILS • PRECISIONBILT WIRE ROPE.

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

J&L STEEL

J&L—PARTNER IN PROGRESS TO AMERICAN INDUSTRY

Advertisement

DISTRIBUTION

From canal clerk to steel head is the story of the late B. F. Jones, founder of Jones & Laughlin. At 18, young Jones, near the middle of the last century, got a job as shipping clerk on the new canal (progenitor of the Pennsylvania Railroad) between Philadelphia and Pittsburgh, hailed then as a great Westward-Ho transportation facility compared to the service of Conestoga wagon trains and stage coaches over the winding mountain trails. Young Jones soon became general manager of the line. Traveling back and forth he noted charcoal iron furnaces springing up wherever pockets of iron ore were discovered and shipping pig iron by canal. Saving his money, in his very early 20s, he invested in a crude little iron rolling mill at Brownsville, Pa., on the Monongahela River. With shrewd appreciation of the advantages of the growing young metropolis of Pittsburgh, he loaded his mill on flatboats, transported it to the South Side of the river at Pittsburgh, and set up a new industry there in 1852. From that small beginning, and by growth alone, without merger, has developed the Jones & Laughlin Steel Corporation—today fourth largest steel producer in the U. S.

Bar iron on horseback was transported over the Orange Mountains to Newark, in 1710, from the iron works at Hanover, N. J.

First American iron exported in regular course of commerce was officially reported as follows: "1650. Sam Hutchinson, merchant, shipped on the ship Charles 3½ tunne, 172 bars of iron for acco. of Ri. Hutchinson, of London." The bars were probably made at Lynn, Mass., site of the first successful iron enterprise in the colonies.

Transport under refrigeration of foodstuffs, both by rail and motor from sources of supply to every locality in the country, is a comparatively simple matter in large sheet-steel containers.

4 home-comfort requirements, winter and summer, are: (1) *Controlled temperature*, never too high or too low, regardless of temperature outside. (2) *Controlled humidity*, air neither too moist nor too dry for comfort and health. (3) *Purification*, air washed or filtered free of smoke, soot, dust particles, pollen, and bacteria. (4) *Circulation*, air kept constantly in gentle motion for good ventilation. After 20 years research by the National Warm Air Heating and Air Conditioning Institute, the goal of all four requirements has been achieved by additions and improvements worked out around the modern sheet steel warm air furnace. "Soon the home without air conditioning may be as rare as the home without a bath tub," the Institute says.

Iron ore is graded more carefully than peas, tobacco, coal or sugar, and according to its chemical analysis, for the various grades of steel for which it is destined.

PROGRESSIVE VISION

WILBUR WRIGHT

Inspired with the possibilities of motor powered sustained flight, after many experiments with gliders, the Wright brothers went to work with the determination to make the flying machine a reality.

Close observation of bird life taught them the secrets of sustained flight.

Excellent knowledge of mechanics, plus bird flight observation, formed the background of their success.

Again progressive vision was responsible for the establishment of a great industry.

THERMALLOY the "EYE" of QUALITY

THE ELECTRO ALLOYS COMPANY

CASTINGS FOR HEAT CORROSION

ELYRIA, OHIO

QUALITY CASTINGS SINCE 1919

METALS *and* METAL PRODUCTS

THE SHENANGO FURNACE CO.

Lake Superior Iron Ores

Bessemer — Non-Bessemer

Aluminiferous

"Shenango" Pig Iron

Bessemer — Basic

Malleable — Foundry

SHENANGO-PENN MOLD CO.

Ingot Molds & Stools

Plants—{Sharpsville, Pa.
{Pittsburgh (Neville Island)

Centrifugally Cast

Alloys of Bronze, Monel Metal, Nickel, Iron and Semi-Steel.

Rolls, Propeller Shaft Bearings, Bushings and Bearings.

Plant—**Dover, Ohio**

Write for Booklet

W. P. SNYDER & COMPANY

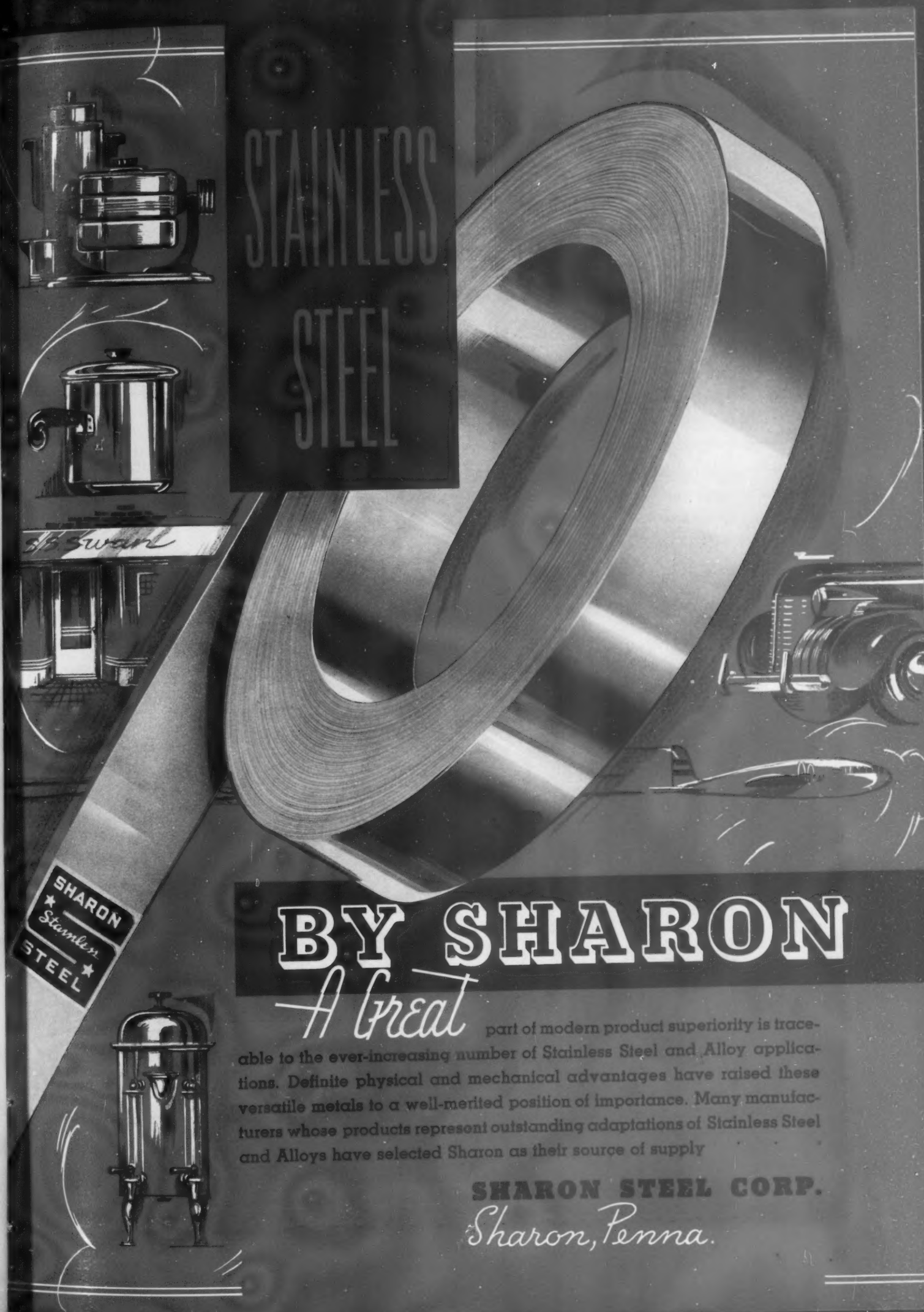
Established 1888

Iron Ore — Pig Iron

Coal — Coke

●

OLIVER BUILDING-PITTSBURGH


STAINLESS STEEL
SHARON
Stainless
STEEL
BY SHARON
A Great part of modern product superiority is traceable to the ever-increasing number of Stainless Steel and Alloy applications. Definite physical and mechanical advantages have raised these versatile metals to a well-merited position of importance. Many manufacturers whose products represent outstanding adaptations of Stainless Steel and Alloys have selected Sharon as their source of supply
SHARON STEEL CORP.
Sharon, Penna.

Not Just *Any* Steel can become WYCKOFF *Cold Drawn* . . .

Steel bubbling from the furnace takes on an identity—a character and a special fitness to do a specific task. Fully appreciating this, WYCKOFF uses only controlled-manufacture steels selected in definite grain sizes, analysis and physical limits best suited to the ultimate use of the finished WYCKOFF product. Metallurgical Control never ceases—follows through every heat treating and cold finishing operation to a final thorough inspection before shipment. With complete knowledge and control of quality from raw steel to precision finished product—WYCKOFF constantly manufactures only the *finest* in cold finished steels.

Widely Distributed in America's Principal Industrial Cities

DRAWN STEEL COMPANY
First National Bank Bldg., Pittsburgh, Pa.
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Mills at Ambridge, Pa., and Chicago, Ill. Warehouse Stocks in Principal Cities
Manufacturers of Carbon and Alloy Steels . . . Leaded Steels . . . Turned and Polished Shafting
(Turned and Ground Shafting . . . Wide Flats up to 12 inches by 2 inches)

If It does it for Others— It will do it for You!

SPEED CASE STEEL

(A LOW CARBON OPEN HEARTH PRODUCT)

AUTOMOBILE Manufacturer SAVED $37.50 per ton of Steel

MACHINE TOOL Manufacturer SAVED $70.89 per ton of Steel

SPARK PLUG Manufacturer SAVED $32.44 per ton of Steel

DRILL PRESS Manufacturer SAVED $60.00 per ton of Steel

WASHING MACHINE Manufacturer SAVED $19.60 per ton of Steel

STOKER Manufacturer SAVED $20.73 per ton of Steel

ELECTRIC MOTOR Manufacturer SAVED $20.00 per ton of Steel

SPEED CASE STEEL X1515

. . . is a Low Carbon Open Hearth Case Carburizing Steel that *Machines Like S.A.E. X1112 • Carburizes Like S.A.E. X1020 • Physical Properties High • Shock Value Excellent • Unusual Ductility •* It Will Increase Your Production and Lower Your Costs .

SEND FOR SAMPLE • TEST IT YOURSELF!

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Canadian Representatives:
PECKOVER'S, Ltd.
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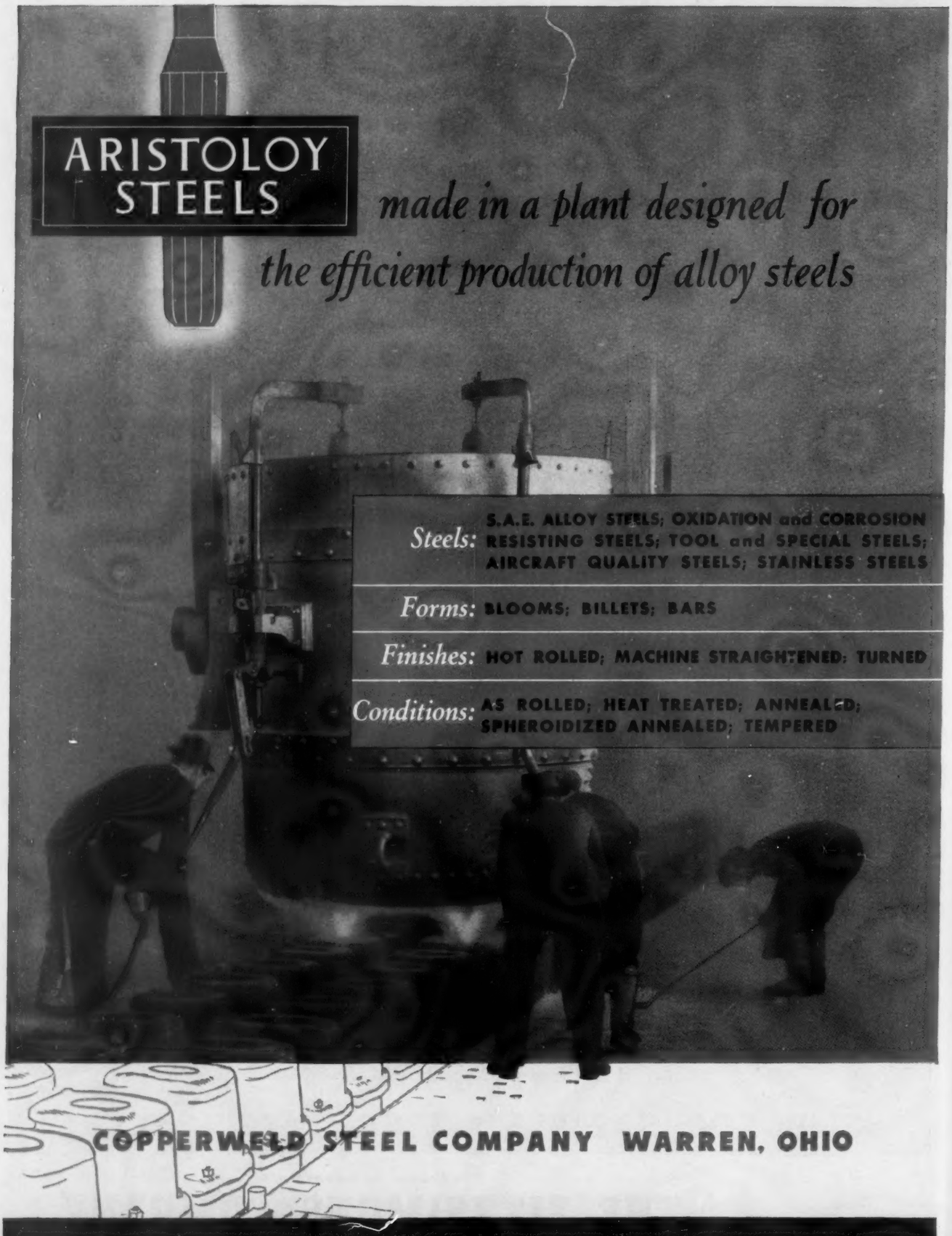
MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS!


ARISTOLOY
STEELS
made in a plant designed for
the efficient production of alloy steels
Steels: S.A.E. ALLOY STEELS; OXIDATION and CORROSION RESISTING STEELS; TOOL and SPECIAL STEELS; AIRCRAFT QUALITY STEELS; STAINLESS STEELS
Forms: BLOOMS; BILLETS; BARS
Finishes: HOT ROLLED; MACHINE STRAIGHTENED; TURNED
Conditions: AS ROLLED; HEAT TREATED; ANNEALED; SPHEROIDIZED ANNEALED; TEMPERED

COPPERWELD STEEL COMPANY WARREN, OHIO

ARISTOLOY S.A.E. ALLOY BILLETS AND BARS; OXIDATION AND CORROSION RESISTING STEELS; TOOL AND SPECIAL STEELS; AIRCRAFT QUALITY STEELS; STAINLESS STEELS

plus

THE VISION and RESEARCH TO DEVELOP STEELS OF THE FUTURE

Half a century in producing Cold Finished Steels is but the first milestone of progress in our service to industry. With steadily growing facilities for cold finishing and furnace treating bar steels . . . and nation-wide distribution of our products . . . we are ready to meet the utmost demands for modern steels . . . plain carbon steel, screw stock, leaded steel or alloy grades. We welcome new tests of our skill in solving your steel problems.

COLD FINISHED STEEL AND SHAFTING

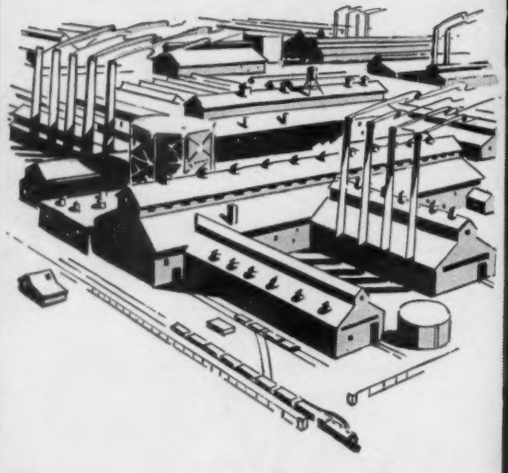
BLISS & LAUGHLIN, INC.

HARVEY, ILL. Sales Offices in All Principal Cities BUFFALO, N. Y.

SINCE

GRANITE CITY STEEL

1878



LARGE ENOUGH

to have the finest of modern steel-making methods, machinery and equipment.

SMALL ENOUGH

to produce your steel orders specifically for *you*..."Tailor-made" to fit your requirements *exactly.*

Although our mills are operating at a high rate of capacity, there will be no deviation from our policy of close personal supervision and rigid laboratory control of every order, regardless of size.

GRANITE CITY STEEL CO.

GRANITE CITY, ILLINOIS

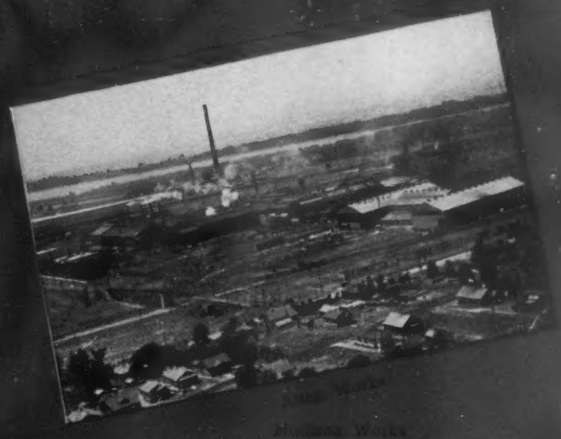
Chicago · Cleveland · Denver · Indianapolis · Kansas City · Los Angeles · Louisville
Memphis · Milwaukee · Minneapolis · Moline · New Orleans · New York · St. Louis

HOT ROLLED SHEETS · COLD ROLLED SHEETS · STRIPLATES · GALVANIZED SHEETS · TIN PLATE · PORCELAIN ENAMEL SHEETS · ELECTRICAL SHEETS · CULVERT SHEETS · TIN MILL PRODUCTS · GALVANNEALED SHEETS

LACLEDE STEEL COMPANY

STEEL AND SERVICE

LACLEDE



MANUFACTURERS OF

OPEN HEARTH STEEL INGOTS

SLABS, BLOOMS, AND BILLETS

WIRE RODS

REINFORCING BARS FOR CONCRETE
Plain or Deformed
Straight Lengths or Fabricated

COLD DRAWN WIRE
Spring Wire; Basic Wire; All finishes, including Bright, Coppered, Galvanized, and Tinned

HOT ROLLED STRIP AND BANDS
Coils or Cut Lengths

COTTON TIES — WOOL TIES

SKELP FOR MANUFACTURING TUBES

MERCHANT BARS AND SHAPES
Rounds, Squares, Small Shapes, Angles, and Special Shapes

PIPE AND TUBES
Black or Galvanized

LIGHT WALL TUBING

CONDUIT FOR ELECTRICAL USE

WELDED WIRE MESH

OPEN WEB STEEL JOISTS

WELDED PRODUCTS FOR BUILDING AND HIGHWAY CONSTRUCTION

Steel Works, Wire & Tube Mills:
ALTON, ILLINOIS
Bar Mills:
MADISON, ILLINOIS

Facilities
Unexcelled For
Export Shipments

LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI

Wire that goes thru the Right Finishing School

A continuous, wet drawing unit in the new WISSCO WIRE MILL, Buffalo, N. Y.

Quality, concentration, temperature and distribution of soap used in wet drawing of wire play important parts in producing uniform bright finish. In the new Wissco Wire Mill soap is under perfect control. The soap solution is kept at a constant temperature and sprayed under positive pressure against the wire and die openings. Thus the wire is perfectly lubricated and the dies are cooled and operate at a controlled temperature.

In order to maintain uniformity of soap quality, temperature, pressure, an elaborate system of soap handling equipment has been installed. Adjoining huge 10,000 gallon storage tanks are a pump house, a mixing tank and pumps for handling soap from tank to tank and to the various drawing machines. Continuous chemical laboratory control assures maintenance of proper acidity, alkalinity and soap concentration.

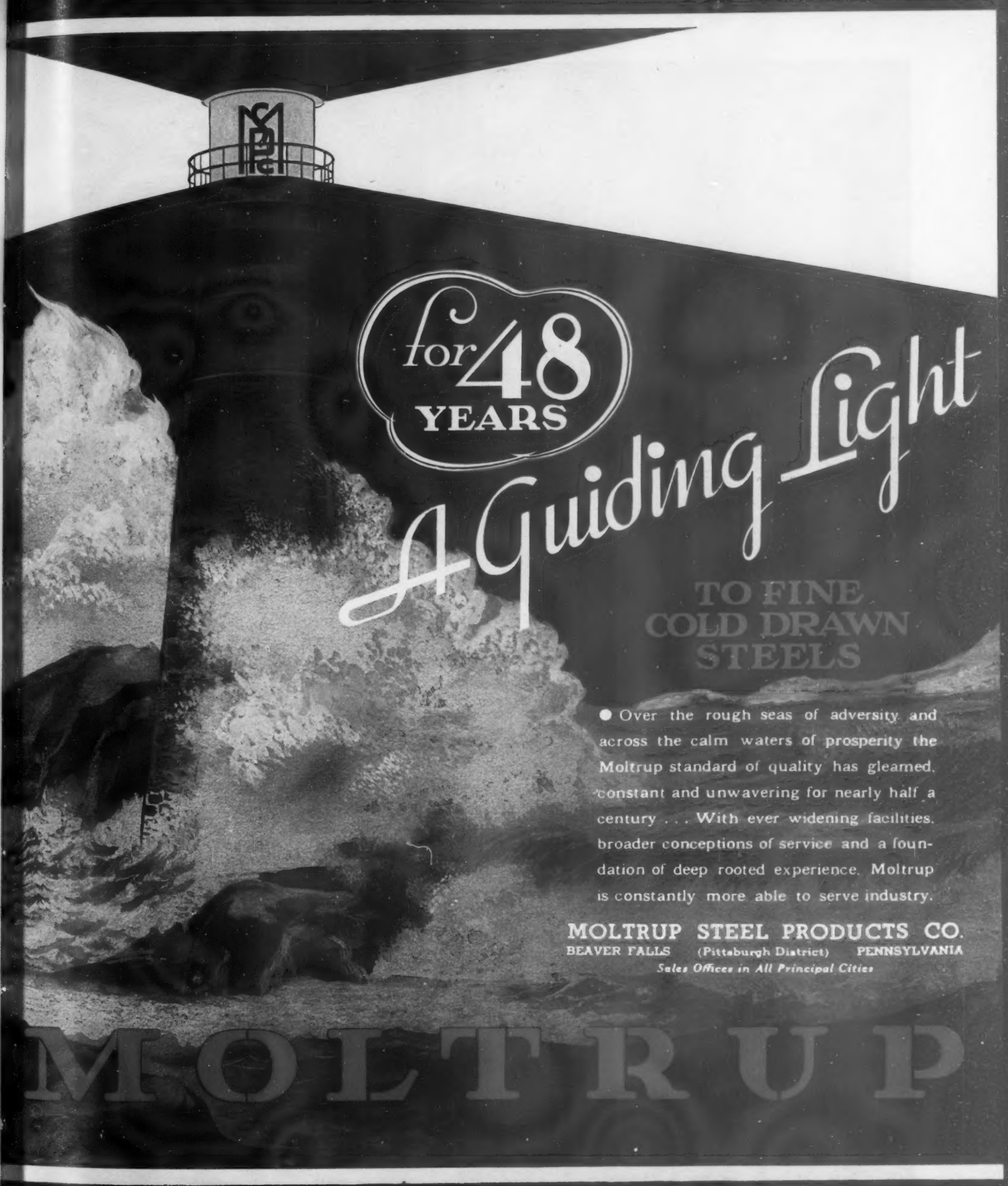
Control of soap solution may seem a far cry from quality wire making. But Wickwire Spencer experts have found from experience that the uniformity of wire is entirely dependent upon the control and uniformity of each step in wire production. The practice of this policy enables Wissco Wire users to enjoy wire of the highest quality and uniformity.

WICKWIRE SPENCER STEEL COMPANY

500 Fifth Ave., N. Y.; Buffalo, Chicago, Detroit, Worcester. Pacific Coast Headquarters: San Francisco. Warehouses: Los Angeles, Seattle. Export Sales Department: New York

Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Dent Spacer Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist—Mattress—Shaped—Rope—Welding—Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical man on your wire problems, however large or small.

WISSCO WIRE
BY WICKWIRE SPENCER


for 48 YEARS
A Guiding Light
TO FINE COLD DRAWN STEELS
● Over the rough seas of adversity and across the calm waters of prosperity the Moltrup standard of quality has gleamed, constant and unwavering for nearly half a century . . . With ever widening facilities, broader conceptions of service and a foundation of deep rooted experience, Moltrup is constantly more able to serve industry.
MOLTRUP STEEL PRODUCTS CO.
BEAVER FALLS (Pittsburgh District) PENNSYLVANIA
Sales Offices in All Principal Cities
MOLTRUP

THE TIME-TESTED MOLYBDENUM STEEL
for all metal cutting tools
MO-MAX
TRADE MARK REG. U.S. PAT. OFF.
MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL
Cutting tools made of MO-MAX are twenty per cent more efficient, take eight per cent less steel than corresponding tools made of 18:4:1. Widely used for eight years, MO-MAX has demonstrated its universal adaptability, reliability, and outstanding economy. For hard, tough tools of superior cutting quality, choose MO-MAX.
Please consult your usual sources of supply. Leading steel companies are licensed to produce their own brands of MO-MAX under patents owned by The Cleveland Twist Drill Co.

Announcing **NEWPORT**

COLORBOND

GALVANIZED SHEETS
with a perfect
PAINT BONDING SURFACE

The introduction of COLORBOND permanently solves the problem of how to paint, enamel, or lacquer a high quality galvanized metal sheet.

In Newport's latest development, galvanized sheets are subjected to certain processes, which produce a different kind of surface. COLORBOND provides greater durability and added rust and corrosion resistance; gives a "tooth" that tightly holds paint, enamel, lacquer and other finishes; increases the value and life of *any* surface treatment that may be used.

COLORBOND is available in steel, copper bearing steel, and GOHI Pure Iron-Copper Alloy, in a full range of sizes and gauges. Literature and details on request.

THE NEWPORT ROLLING MILL CO.
NEWPORT KENTUCKY
DIVISION OF
THE ANDREWS STEEL CO.

NEWPORT PRODUCTS: HOT ROLLED SHEETS • ELECTRICAL SHEETS • GOHI PURE IRON-COPPER ALLOY • GLOBE BRAND GALVANIZED STEEL SHEETS, ROOFING AND SIDING • GOHI ENAMELING IRON SHEETS • KCB COPPER STEEL SHEETS • NEWPORT LONG TERNE SHEETS • NEWPORT GALVANNEALED AND DELUXE METAL SHEETS

The Right "FOLLOW THROUGH" Counts in Making Quality Steel

Air view of Wisconsin Steel Works by Chicago Aerial Survey Co.

Users of alloy and carbon steels recognize the value of dealing with a firm that "follows through."

Wisconsin Steel maintains a rigid "follow through" policy. It begins when the salesman writes the order. It continues through every operation at Wisconsin Steel's modern, up-to-date plant. A competent staff sees that the finished product measures up to the most exacting specifications.

Wisconsin Alloy and Carbon Steels are being used successfully by manufacturers in many lines of business. Ask us to point out how your business can benefit from Wisconsin Steel's "follow through" policy. We are well equipped to supply a full range of alloy and carbon steels, as well as high quality pig iron that is "better controlled from mine to mold." Write or phone us. Inquiries will receive prompt attention.

WISCONSIN STEEL COMPANY

General Offices:

180 North Michigan Avenue, Chicago, Illinois

Affiliate of International Harvester Company

WISCONSIN STEEL

STEEL FROM WAREHOUSE

for Immediate Delivery

115 YEARS OF SERVICE TO INDUSTRY

BEALS-McCARTHY & ROGERS INCORPORATED BUFFALO NEW YORK

Kitchen in the Clouds

A delightful dinner, a speedy trip and a safe landing—TIMKEN Stainless Steel in the kitchen, TIMKEN Alloy Steels in many vital parts of fuselage, wings and power unit, TIMKEN Bearings in landing wheels, rocker arms and TIMKEN Alloy Steel in landing gears.

The TIMKEN Company is a leading aircraft steel source because TIMKEN has the largest facilities in the world for producing steel that readily meets rigid aircraft specifications.

Whatever you are making, the comparative cost of the steel is so little, you can't afford to buy anything less than the best. Consult us today.

TIMKEN
ALLOY STEELS

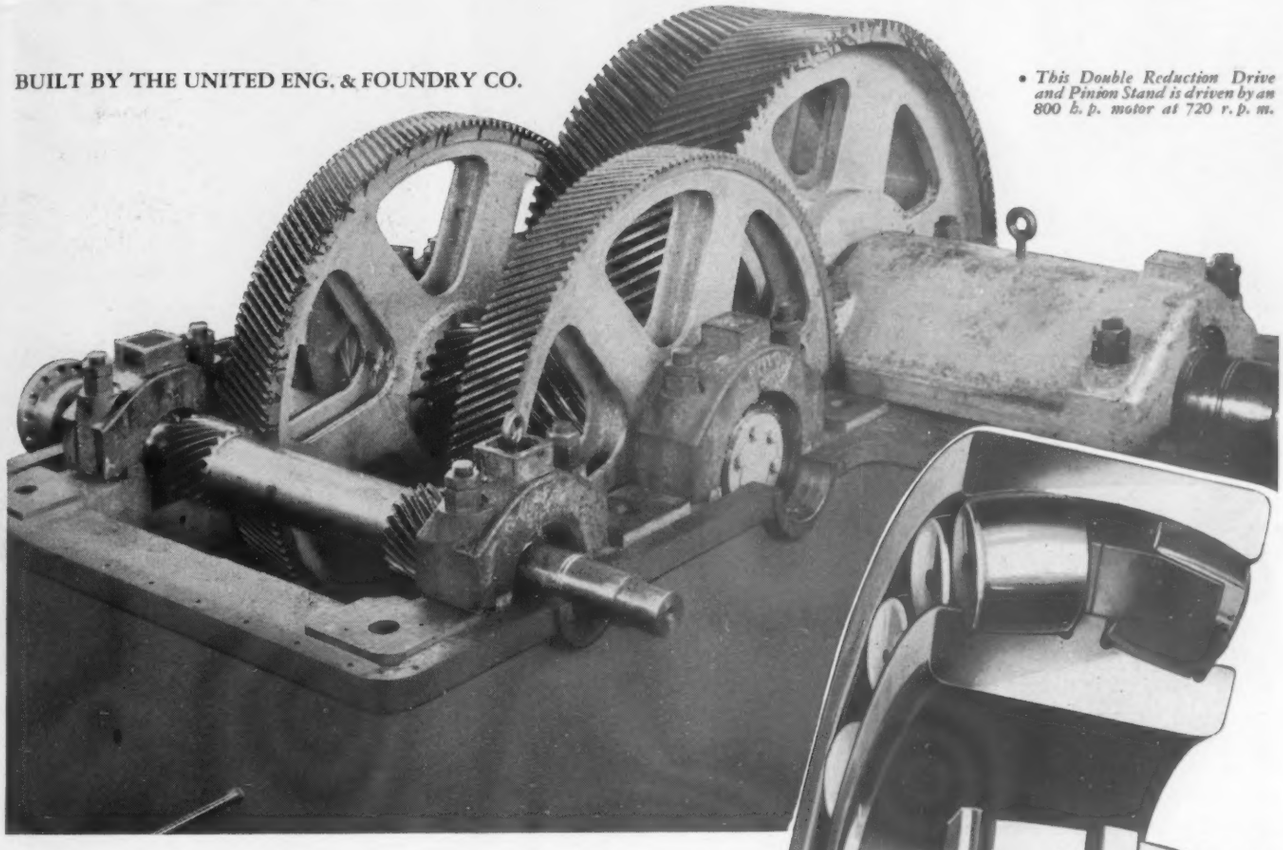
Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

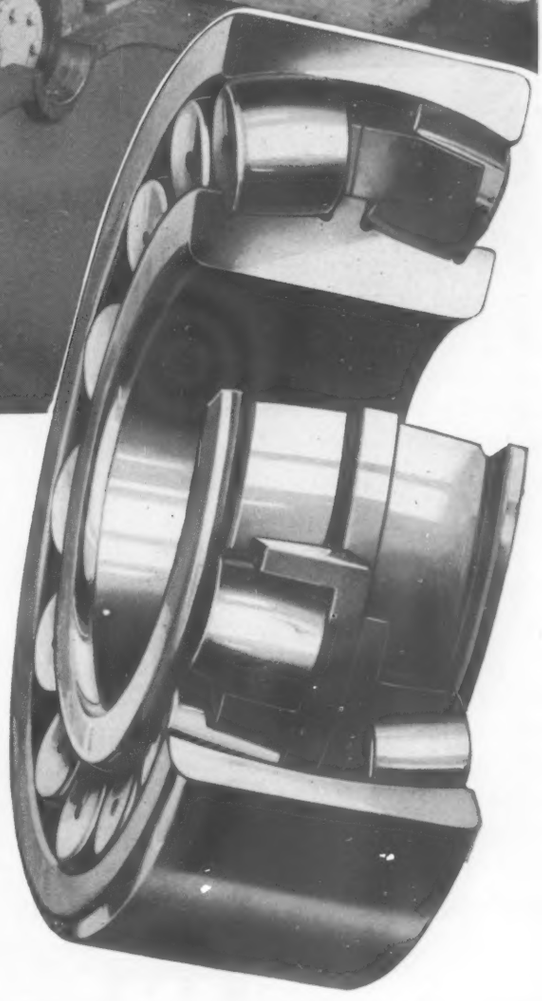
Drives that drive . . and drive . . and drive

WITHOUT BEARING TROUBLE

BUILT BY THE UNITED ENG. & FOUNDRY CO.



• *This Double Reduction Drive and Pinion Stand is driven by an 800 h. p. motor at 720 r. p. m.*



Driving *without bearing trouble* is easy for this well-built and soundly engineered Double Reduction Drive and Pinion Stand. On its high speed, intermediate, low speed combination and mill pinion shafts are SKF Spherical Bearings . . . with *inherent rolling alignment* and *high capacity* to assure long gear life and low maintenance costs. The self-aligning feature relieves the tendency of outer races to "work out" their seats under heavy load and resultant shaft deflection. Submit *your* designs for proposal . . . TODAY. 4715

SKF INDUSTRIES, INC., PHILADELPHIA, PA.

SKF

SPHERICAL BEARINGS

Tiny changes in temperature, so small that you can see them on the chart only with a magnifying glass, are more than large enough to start Micromax control action. And correction of the change starts when recording starts . . . doesn't wait till a change is recorded. That's one reason for extreme steadiness of heat under Micromax Control.

You Would Need A Glass

To See What A Micromax Pyrometer "Sees"

Suppose you were regulating the heat to a furnace, by hand, using a Micromax Pyrometer's record as a guide.

Every time, then, that Micromax showed you a change in temperature, you'd turn the valve or damper. After a little practice, you'd keep the temperature quite uniform.

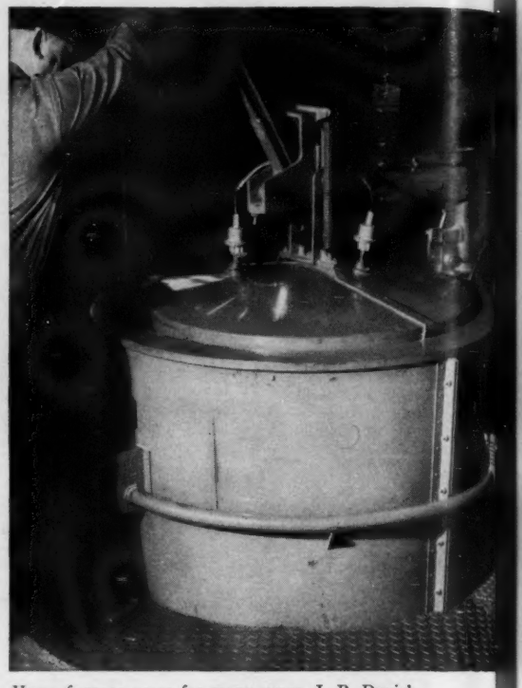
But, unless you held a reading-glass to the record, you couldn't keep the same uniformity that a Micromax Pyrometer keeps when it automatically operates its own valve-drive. For without the glass, you couldn't see changes as soon as the instrument "sees" them. And you couldn't respond as quickly and accurately as the instrument responds.

The reason is summed up in the "micro-responsive" balancing unit of Micromax. This vital unit, the unique product of a quarter-century of development, responds *early* to each tiny deflection of the instrument's temperature-driven pointer. It allows no clearance—no space through which the pointer can move before its motion causes corresponding motion of the valve. The effect is as responsive as though the pointer acted snugly and directly on the valve. Temperature changes are headed off with a smooth efficiency that sets new standards for automatic control.

See Catalog N-00A for models and other information.

Wrench Maker Finds Uniform Homo Tempering Ends All Rejections

From 300 to 1200 lb per hour of forged-steel wrenches are tempered in this Homo furnace by J. P. Danielson & Co., Jamestown, N. Y. The smaller production rate is secured on their "Betr Grip" vanadium alloy tools, which are tempered at a high heat. The larger rate is for carbon-steel tools, tempered at 400 F.



Homo furnace users for many years, J. P. Danielson & Co. recently added this new, modern Homo to their heat-treat.

"We never have to reject a Homo-tempered wrench, if the hardening and quenching are uniform," says the Danielson Company. "More important, however, is the fact that we can greatly improve the uniformity of the temper, even when the hardness isn't so uniform. Fast as it is, the Homo heats gently —it applies heat softly, without undue shock. And Homo doesn't develop hot spots which overdraw some tools, nor cold spots which leave others too hard. It brings every part of every wrench to correct temperature, and holds it there as long as we wish. Wrenches simply have to be uniform when tempered in the Homo."

Part of a "Betr Grip" wrench, just as it comes from Homo tempering furnace.

There's a Homo Furnace of type, size and temperature range for every parts-tempering need. You'll find them described in Catalog T-625, sent on request.

LEEDS & NORTHRUP COMPANY, 4957 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad ENT-0600C(10)

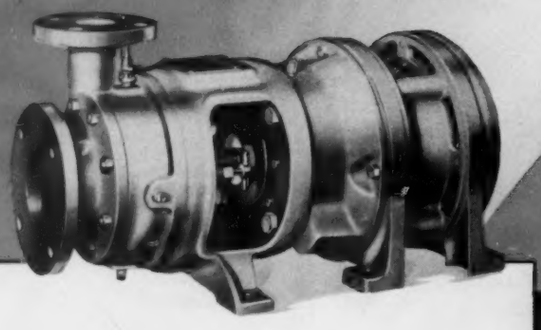
For the PRESSING *Needs of* '41

Modern Cleveland Four Point Presses—500 tons capacity—108" between the uprights—24" stroke—6" adjustment.

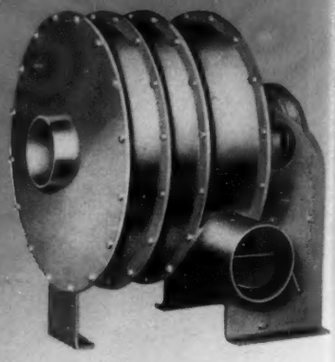
Speed, accuracy and economy of production—these are the Pressing needs of '41 and Cleveland is fully prepared to meet them, not only with Modern Single Point, Two Point and Four Point Presses but also with eleven other distinct types including Inclinable, Punch Type, Horning, Knuckle Joint, Straight Sided Crank, Double Action Toggle, etc., each of which incorporates every known feature for efficiency and low cost operation.

Modern Presses THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

MODERN COMPRESSED AIR a



MOTORPUMPS combine the pump and motor in one unit. They operate in any position. Pressures: 5 to 215 lbs. Capacities: 5 to 1500 gpm. Catalog 7664.



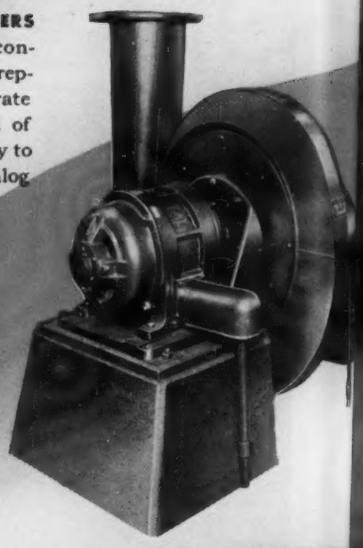
TYPE "G" MOTORBLOWERS have been designed principally for supplying air to oil and gas furnaces. Volumes: 100 to 4500 cfm. Pressures: 8 oz. to 2¼ lbs. Catalog 2626.

● There is real heavy work ahead for the Metal Industry, and in doing this work nothing short of the best equipment can assure uninterrupted service.

For more than 70 years, Ingersoll-Rand has pioneered in the development of air compressors, blowers, pneumatic tools, pumps, engines, condensers and a host of other machines—equipment that so many industries depend upon for their defense program work.

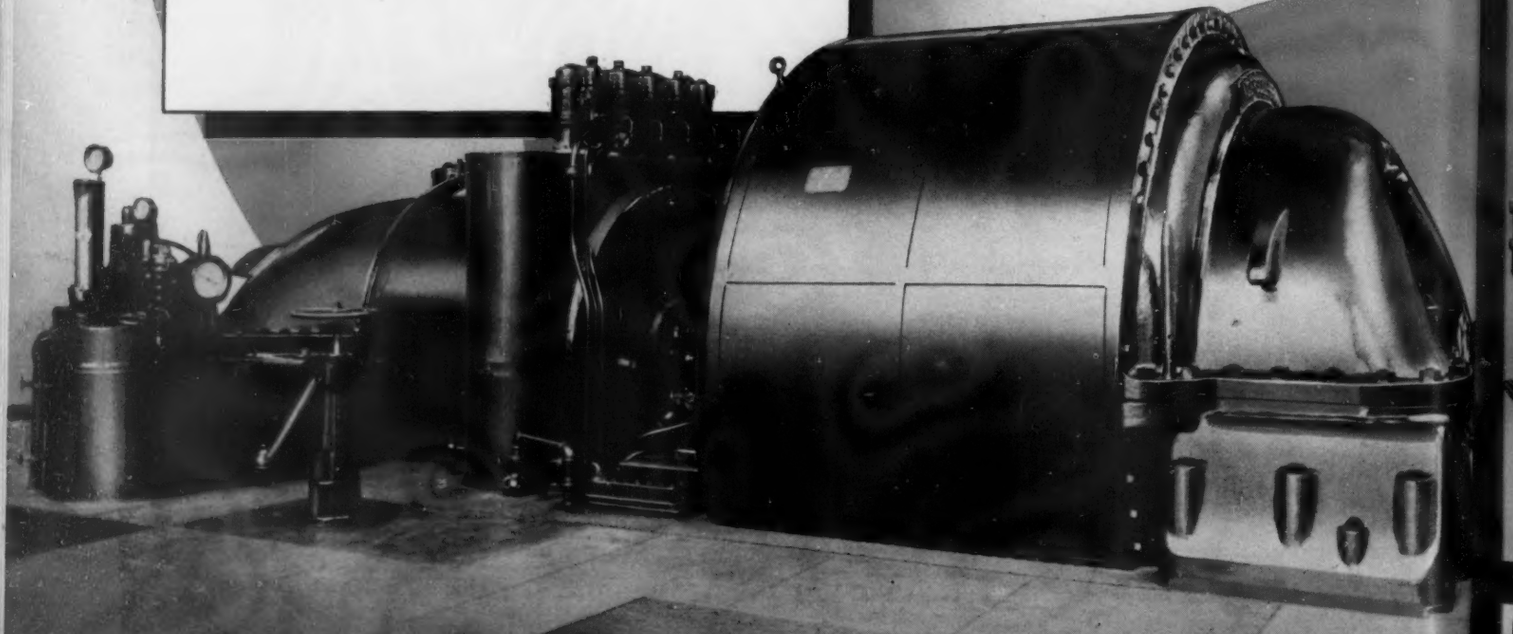
Each of the I-R units, a few of which are shown on these pages, can be relied upon for steady and efficient performance. And remember, the Company's interest in a machine or tool is continuous during its entire lifetime—that is your assurance of real service when you need it.

Perhaps an I-R specialist can help you with your production set-up. Don't hesitate to call on him. There is no obligation.



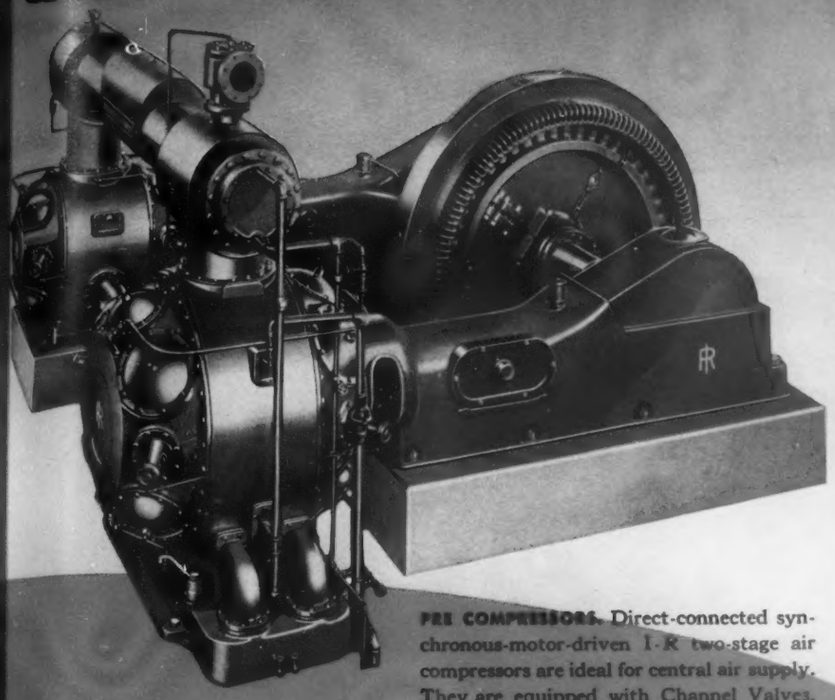
CUPOLA MOTORBLOWERS with Ingersoll-Rand constant air-weight control represent the most accurate and convenient method of insuring proper air supply to gray iron cupolas. Catalog 2145-A.

BLAST FURNACE BLOWERS. More than 100 Blast Furnace and Bessmer Converter blowers built by Ingersoll-Rand are in operation today. Unequalled building and testing facilities are employed in manufacturing these large turbo blowers.

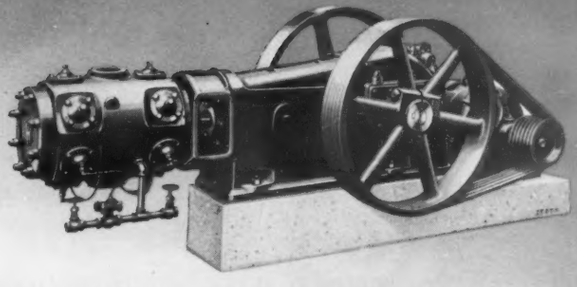


Atlanta Birmingham Boston Buffalo Butte Chicago Cincinnati Cleveland Dallas Denver Detroit Duluth El Paso Hartford Houston Kansas City Knoxville Los Angeles Newark New Orleans New York Philadelphia Picher Pittsburgh Pottsville Salt Lake City San Francisco Scranton Seattle St. Louis St. Paul Tulsa Washington

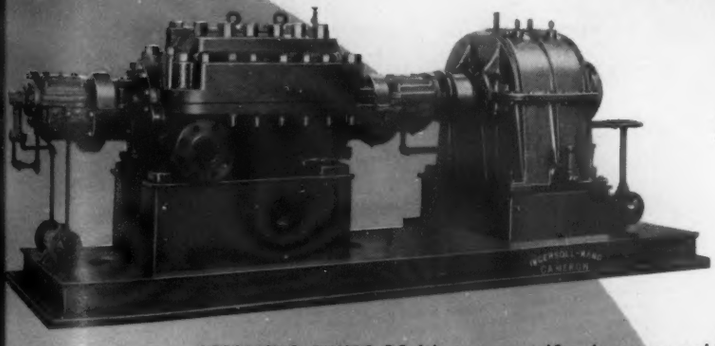
R and PUMPING MACHINERY



PRE COMPRESSORS. Direct-connected synchronous-motor-driven I-R two-stage air compressors are ideal for central air supply. They are equipped with Channel Valves, efficient two-stage intercoolers and 5-step clearance control. Sizes: 200 to 3000 hp. Catalog 3426. Comparable steam-driven units available. Catalog 3444.

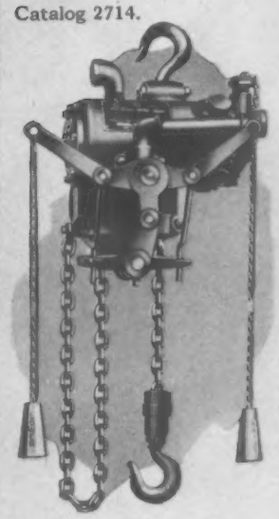


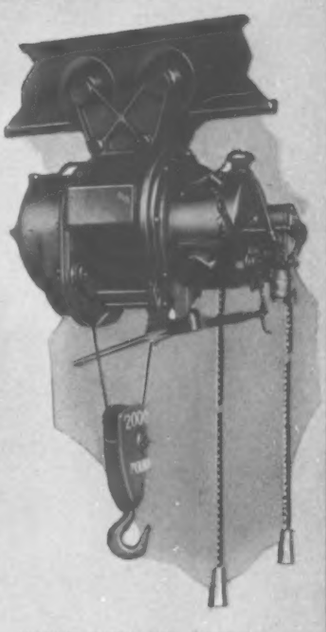
ES COMPRESSORS are heavy-duty air and gas units for a wide range of service. Pressures: 5 to 2500 lb., and vacuums. Sizes: 5 to 125 hp. Also available with steam power cylinder. Catalog 3063-B.



DESCALING PUMPS. Multi-stage centrifugal pumps are ideal for boiler feed and for descaling service. The complete line ranges from 20 to 3000 gpm with pressures to 1800 lbs. Catalog 7258.

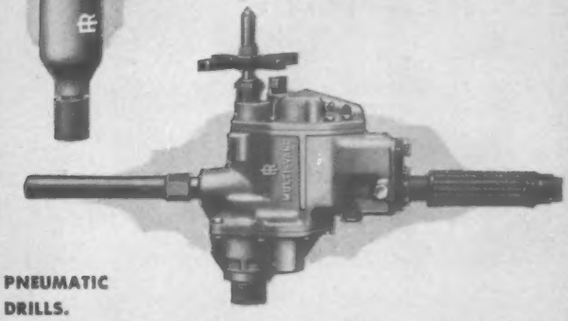
THE AIR-BLOC. This modern lift for light loads speeds up production on a multitude of jobs. Capacities: 300, 500, 700 lbs. Catalog 2714.



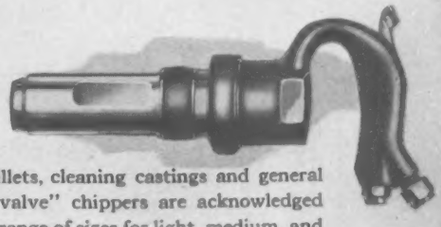


HEAVY-DUTY AIR HOISTS are built in capacities ranging from 500 to 20,000 lbs. Safest for use around the shop—trolley or hook mounting. Catalog 12100.

IMPACT WRENCH. This revolutionary wrench continues to show amazing economies under severe service. Reversing and non-reversing styles for every need. Catalog 12100.



PNEUMATIC DRILLS.
Complete lines of piston type and "Multi-Vane" pneumatic drills are made for all ordinary shop uses and for many special services, such as close-quarter drilling and flue rolling. Catalog 12100.



CHIPPING HAMMERS.
For chipping billets, cleaning castings and general work "flapper valve" chippers are acknowledged leaders. A wide range of sizes for light, medium, and heavy work is available. Catalog 12100.

HAND-HELD GRINDERS. "Multi-Vane" grinders are especially designed for fast work on castings and metal welds—positive control, light weight and speed variation. Catalog 12100.

Ingersoll-Rand

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WE DO THIS SORT OF THING EVERY DAY!

• A chemical manufacturer wanted a vertical off-take from a dome arch in one of his furnaces. He put the problem up to Carborundum and the picture of that section of the twenty-foot diameter arch shows the result. We are proud of this job because it is a combination of sound engineering design and manufacturing skill.

This is but one of many big or unusual jobs we have done . . . given to us because of the results we have been able to achieve.

Isn't it reasonable to conclude that a manufacturer with such a background can handle your refractory problems, large or small, with a minimum of delay and assure you of long, economical refractory service?

With a complete group of super-refractory products—Carbofrax (silicon carbide), Alfrax (fused alumina), Mullfrax (mullite), plus the experience gained through years of research, Carborundum offers you a service that will pay handsome dividends. Call our nearest representative today.

Refractory Division

THE CARBORUNDUM COMPANY

REG. U. S. PAT. OFF.

PERTH AMBOY, N. J.

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Co., El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

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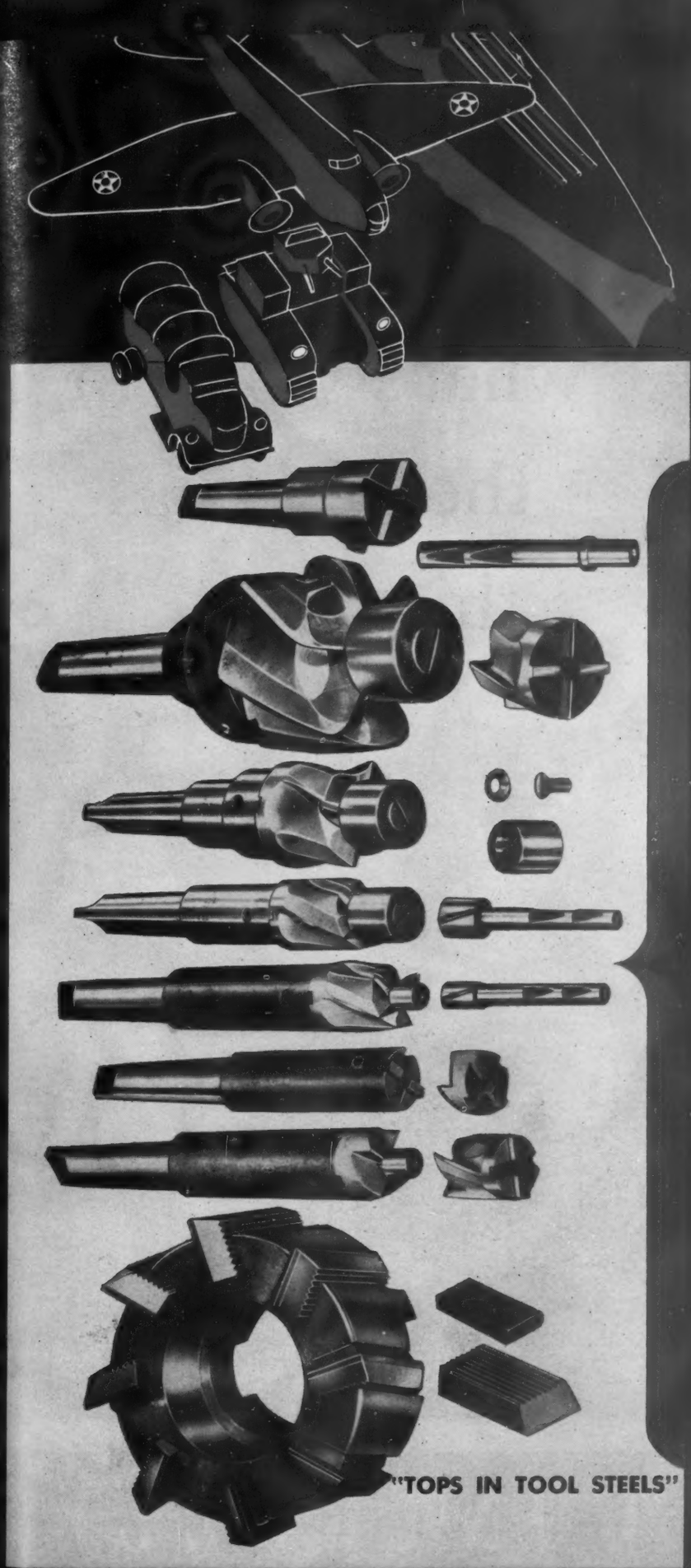

"TOPS IN TOOL STEELS"

Now...

AS IN 1917-18

AMERICA'S DEFENSE RELIES ON THIS TRULY GREAT TOOL STEEL ★ ★ ★

RED CUT SUPERIOR

THE NATIONALLY PREFERRED HIGH SPEED STEEL FOR THESE AND THOUSANDS OF SIMILAR CUTTING TOOLS FOR EVERY CONCEIVABLE APPLICATION —IN PLANTS LARGE OR SMALL, FROM MAINE TO CALIFORNIA

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GET THE FACTS FROM YOUR **VASCO** REPRESENTATIVE

Vanadium-Alloys STEEL CO. LATROBE, PA.

U·S·S CONTROLLED S

CARNEGIE - ILLINOIS STEEL

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

IF IT'S A PROBLEM IN STEEL WHY NOT PUT IT UP TO US . . .

HERE, for example, are typical letters from some disheveled desks we have helped straighten out—

. . .

"We want to thank you and especially your Mr. B—— for clearing up the trouble we were having in hardening our washers. These formerly showed consistently poor Rockwell hardness, varying from Rockwell C-45 to C-63. Since installing the agitating equipment in our oil quench as recommended by yourselves, the washers come through with Rockwell range of C-49 to C-51. And they are hardened right through. Need we say we are extremely well satisfied?"

. . .

"There has been far more uniformity in all the processing operations and many troubles have been eliminated. Better cutting of teeth, and hardening with less breakage and warpage are characteristic since adopting U·S·S Controlled Steels."

. . .

"We make couplers for passenger and freight cars. Their successful operation depends mainly upon the spring contained inside the coupler. Because we were trying to make a spring with greater minimum load requirements than any given A.R.A. spring of similar size, we were having plenty of difficulty. The changes in our heat-treating process recommended by your metallurgical contact man required drastic changes in our equipment, but these changes were made. We are pleased to report that we are now processing a spring that meets every specification and does everything we expected of it."

. . .

"For years we have been using a complicated heat-treating practice on our motor parts. It took time and cost money. We credit your metallurgist for showing us how, by using U·S·S Controlled Steel, we could simplify our heat treatment. We are now getting results as good or better than before—and with no added cost for steel. We figure it will save us many a headache and thousands of dollars to boot."

. . .

We welcome the chance to show you what U·S·S Controlled Steels can do for you. Here are plain carbon steels for forming, forging, heat treating and machining in which all quality factors are definitely predetermined and kept uniform in shipment after shipment. Invite us to demonstrate their money-saving possibilities.

USS

D STEELS

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UNITED STATES STEEL

STOP YOUR BOLTS, NUTS AND SCREWS FROM LOOSENING *with* EVERLOCK WASHERS

U. S. PAT. NO. 1775705

Washer Tongue Detail

YOU can avoid the costly annoyance of loosened parts by using EVERLOCK WASHERS in your assemblies . . . The powerful spring tension of every EVERLOCK WASHER tongue coupled with the bite of its teeth, does the job more thoroughly than other types of fasteners . . . Pictured is an enlarged EVERLOCK tongue and a few of the different types that are used by the millions on a vast variety of products . . . Service calls due to loosened nuts, bolts and screws on equipment where EVERLOCK WASHERS are used, is unknown . . . There's an EVERLOCK WASHER of the correct type and size for every purpose.

Immediate Deliveries

OFTEN OTHER WASHERS HAVE BEEN TRIED, NOW EVERLOCKS ARE SPECIFIED

PRINTED IN U.S.A.

THOMPSON-BREMER & CO. 1640 W. HUBBARD ST., CHICAGO, ILL.

☆

How to Slice a Meteorite!

☆

Cutting up meteorites is a routine job for experts of the Department of Geology at the United States Museum in Washington.

The slicing of this hard, dense material is done with a toothless band saw traveling at 950 feet a minute, using No. 100-grit Carborundum Brand Silicon Carbide Grain with water. After a straight cut has been carefully made, the slice is lapped and polished. Grain in sizes 100, F, and 600 is used successively with a special lapping machine, and the final finishing is done on a felt buffer charged with 600-grit powder. The specimen is then ready for public display.

The chances are you will never have to slice a meteorite but this kind of job has an important meaning for you. It is another example of the fact, that in almost any problem involving the use of abrasives you can depend on Carborundum for the *right* abrasive product for the purpose.

AN INVITATION TO EXECUTIVES CONCERNED WITH MANUFACTURING

Whatever you make, there are two ways in which The Carborundum Company's Abrasive Service can help you. First, highly trained abrasive engineers are ready to help solve any special grinding or finishing problem that may confront you. Second, they will study your present abrasive set-up without obligation, report on its efficiency and, wherever possible, indicate how production can be improved or savings effected. Write to The Carborundum Company, Niagara Falls, N. Y. and a representative will call.

Meteor photograph from Yerkes Observatory, Courtesy University of Chicago Press.

CARBORUNDUM
REG. U.S. PAT. OFF. BRAND
ABRASIVE PRODUCTS

FOR ACCURACY AND ECONOMY IN MANUFACTURE

The Cincinnati Bickford

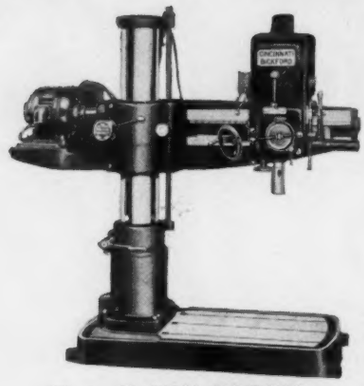
SUPER SERVICE

Upright and Radial

METAL DRILLING MACHINERY

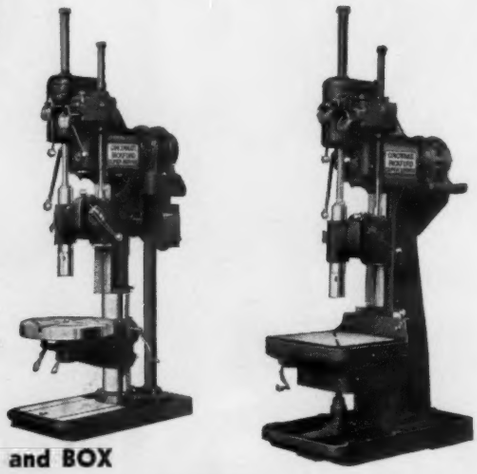
Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE.

Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.



3' or 4' ARM RADIAL
WITH 9" COLUMN
BULLETIN R-21-A

3' ARM 11" COLUMN
TO 8' ARM 19" COLUMN
RADIALS
BULLETIN R-24



21", 24" & 28"
ROUND and BOX
COLUMN UPRIGHTS
BULLETIN U-25

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY, CINCINNATI, OHIO, UNITED STATES OF AMERICA

★ GUARANTEED STRONGER ★

In an effort to present *facts* to the trade, we offer at right data covering Cleveland Hexagon Head Cap Screws made from S. A. E. 1035 steel, heat treated. These tests were made in an independent physical testing laboratory. Compare them with the strength of the screws you are now using, keeping in mind that Cleveland High Carbon Cap Screws, in most sizes, cost no more. *Stocked* from 1/4" x 3/8" to 1" x 6", fine or coarse thread, packages or bulk. Larger and longer sizes made to order. Write for samples, catalog E and discounts.

HEXAGON HEAD CAP SCREWS 1035 HEAT TREATED

All results based on Root Diameter.

TENSILE STRENGTH PER SQUARE INCH IN LBS.

Diameter	Test No. 1	Test No. 2	Test No. 3	Average
1/4"-20	159,500	156,500	160,500	158,834
5/16"-18	163,400	162,800	161,200	162,700
3/8"-16	167,100	167,000	166,800	166,967
7/16"-14	147,700	147,000	146,900	147,200
1/2"-13	146,700	146,000	148,700	147,134
5/8"-11	135,600	134,600	135,500	135,234
3/4"-10	122,700	123,300	123,000	123,000
7/8"-9	124,600	126,000	126,600	125,734
1"-8	118,400	118,000	118,900	118,434

THE CLEVELAND CAP SCREW COMPANY • 2934 East 79th Street • Cleveland, Ohio

CLEVELAND CAP SCREWS

SET SCREWS • BOLTS AND NUTS

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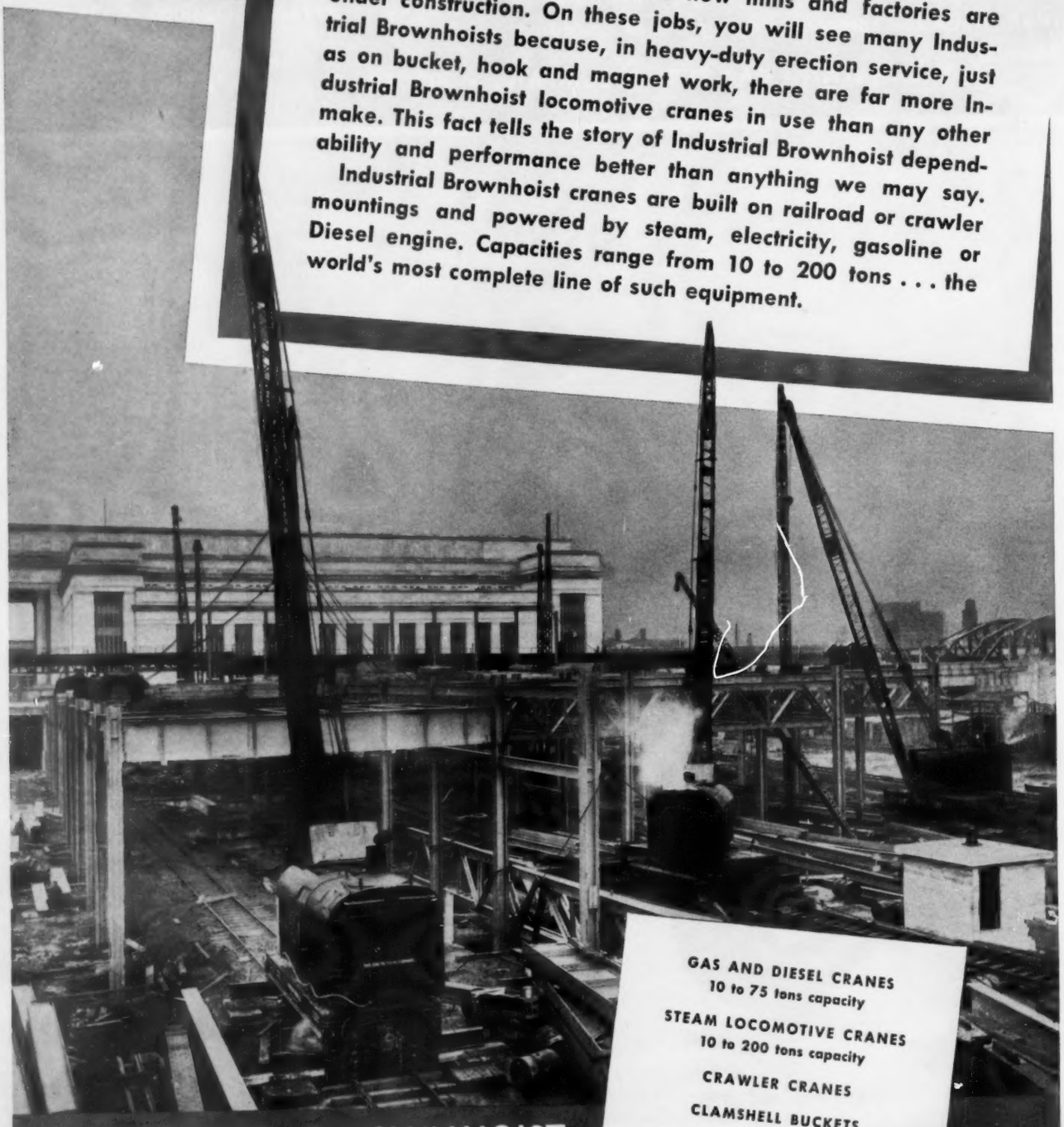
STEEL...Going Up!

All over America, numerous new mills and factories are under construction. On these jobs, you will see many Industrial Brownhoists because, in heavy-duty erection service, just as on bucket, hook and magnet work, there are far more Industrial Brownhoist locomotive cranes in use than any other make. This fact tells the story of Industrial Brownhoist dependability and performance better than anything we may say.

Industrial Brownhoist cranes are built on railroad or crawler mountings and powered by steam, electricity, gasoline or Diesel engine. Capacities range from 10 to 200 tons . . . the world's most complete line of such equipment.



GAS AND DIESEL CRANES
10 to 75 tons capacity

STEAM LOCOMOTIVE CRANES
10 to 200 tons capacity

CRAWLER CRANES

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PILE DRIVERS

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York, Philadelphia, Pittsburgh, Cleveland, Chicago,

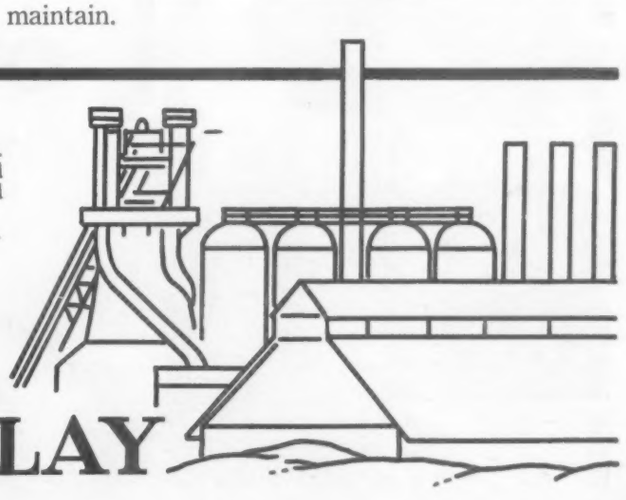
What could be more fundamental than Clay?

ACCORDING to poetic thought, clay is the beginning and end of man. Literature contains thousands of references to clay: it is mentioned in the Scriptures, in sermons, in speeches and epitaphs. However, when Longfellow says that "this vast ball, the earth, was molded out of clay, and baked in fire"—when Shakespeare says that "Imperial Caesar, dead and turned to clay"—when Lord Byron says (describing the Battle of Waterloo) "The earth is covered thick with other clay, which her own clay shall cover"—, it is not to be supposed that ordinary clay is meant. And when we speak of our MAYPORT CLAY, we don't mean ordinary clay either. Millions of years ago, nature was particular in the quality of fire clay deposited in the foothills of the Allegheny Mountains at Mayport, Pennsylvania. For this reason, we have never shipped a car of inferior clay—not in the thirty-five years we have been in business, and, today this product has achieved the enviable position of being the standard by which the quality of other clays is judged. In this, our Thirty-Fifth Anniversary, we feel that every car of MAYPORT clay is another bolt in our armour of reputation, a reputation which we cherish highly and strive to maintain.

ANALYSIS

MAYPORT FIRE CLAY—12 to 65 mesh—3008 degrees Fahr. to 3080 degrees Fahr. Specifications from 60 per cent flint and 40 per cent plastic. 80 per cent plastic and 20 per cent flint, and ALL plastic.

MAYPORT SILICA CEMENT—80 mesh—3080 degrees Fahr.—80 per cent ganister, 20 per cent Mayport Clay.



FRANK B. POPE CO.
Koppers Bldg. Pittsburgh, Pa.

MAYPORT CLAY

JOIN the revolution that is taking place in the handling of this essential material.

Lower costs while speeding the movement of various kinds of scrap, including auto bodies, wire, engine blocks and non-magnetic spiegel iron.

New records are being established

with

OWEN GRAPPLES

which embody an entirely new principle of operation.

Get the complete story, substantiated by many interesting photos, in our new catalog, just off the press.

THE OWEN BUCKET CO.
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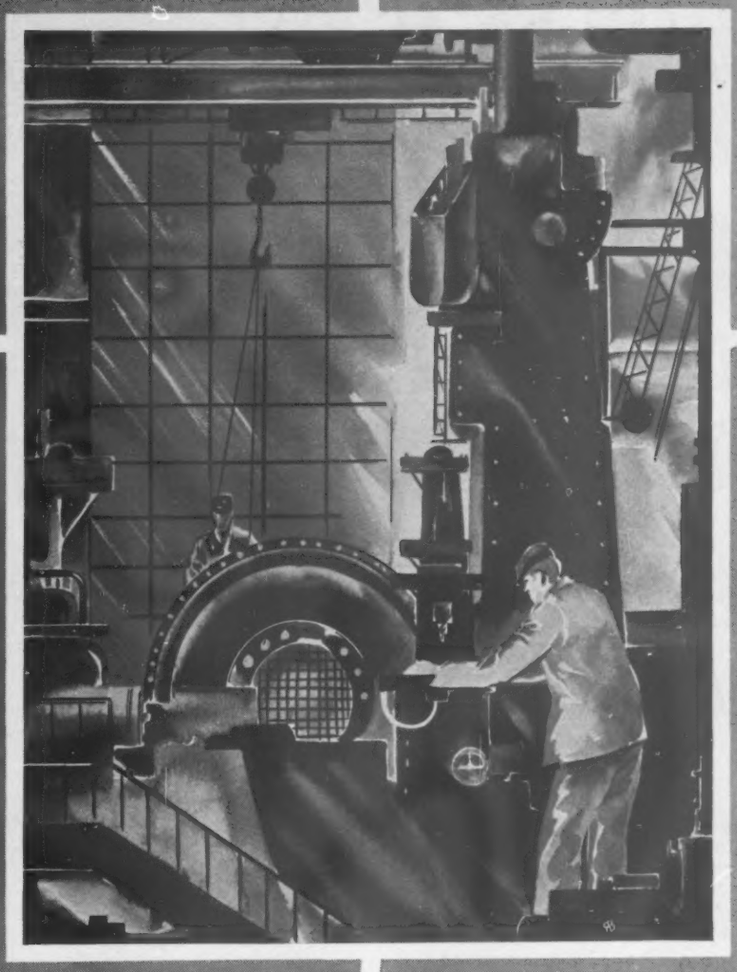
BRANCHES: New York, Philadelphia, Chicago, Berkeley, Cal.



ENGINEERING EQUIPMENT AND SERVICE

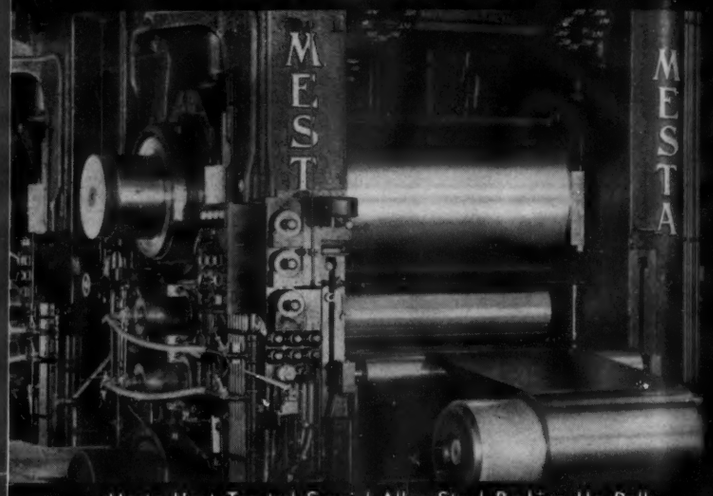
MESTA

ROLLS

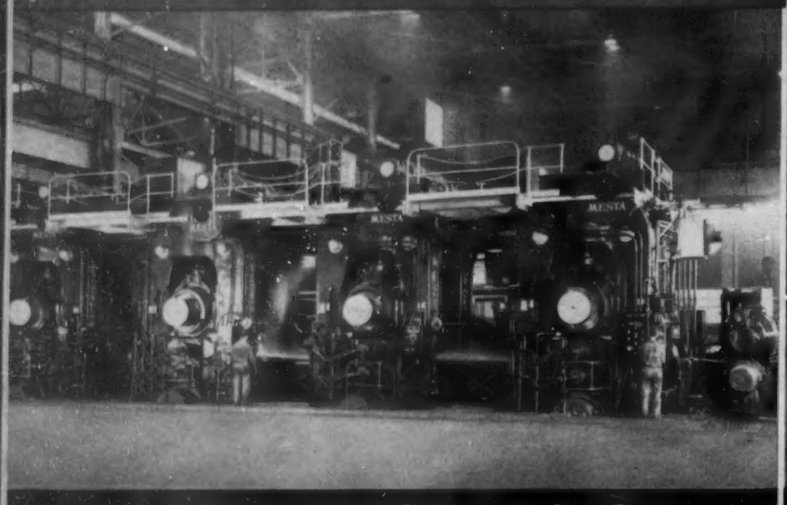
STEEL MILL EQUIPMENT

HEAVY DUTY MACHINERY

Mesta 60" Heavy Duty Roll Grinder



Mesta Heat Treated Special Alloy Steel Backing Up Rolls for Four-High Hot and Cold Mills

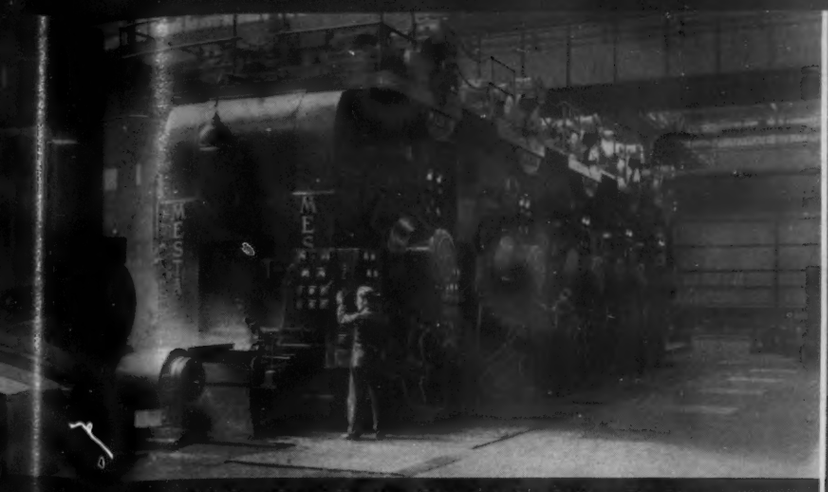


54" Four Stand Tandem Cold Mill for Rolling Thin Sheet Gauges

Mesta Forged Hardened Steel Working Rolls for Cold Mills

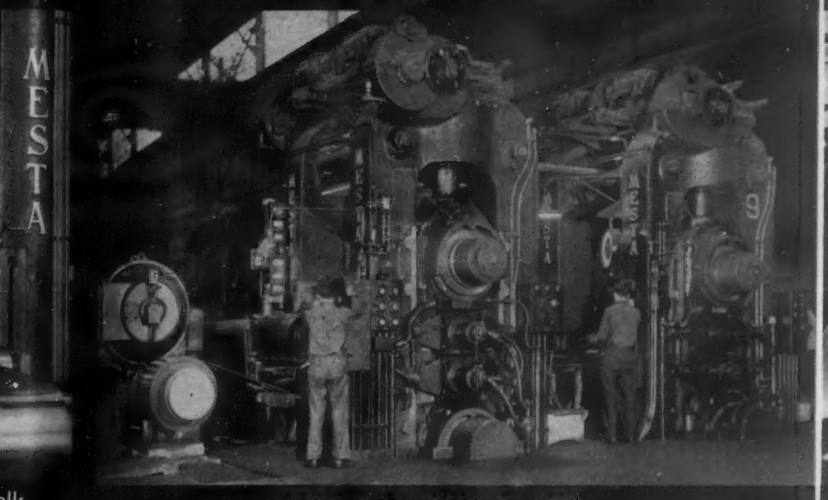
6,000 Ton Pure Hydraulic Quick Acting Forging Press Forging 100" Ingot

84" Heavy Duty Boring and Turning Lathe



42" Five Stand Tandem Cold Mill for Rolling Tin Plate

Mesta 46" Slabbing-Blooming Mill
with Mesta Patented Electrically Operated Manipulator



42" Twin Stand Skin Pass Mill

Finishing Stands, 80" Four-High Continuous Hot Strip Mill

Mesta-Thomson-Gibb Butt Welder in Mesta Pickling Line

Machining 214,000 Lb Steel Casting on 14' Heavy Duty Planer

MESTA PRODUCTS

are built in the largest unit plant in the world devoted to the production of ROLLS and STEEL MILL EQUIPMENT

COMPLETE ROLLING MILL EQUIPMENT

Bar Mills
Billet Mills
Blooming Mills
Continuous Mills
Merchant Mills
Non-Ferrous Mills
Piercing Mills
Pipe Mills
Plate Mills
Rail Mills
Rod Mills
Sheet Mills
Shovel Mills
Skelp Mills
Slabbing Mills
Four-High Hot Strip Mills
Four-High Cold Strip Mills
Structural Mills
Tin Plate Mills
Tire Mills
Tube Mills
Universal Mills
Wheel Mills

Mesta Patented Flying Shears
Bar Shears
Billet Shears
Bloom Shears
Crop Shears
Hydraulic Shears
Lever Shears
Plate Shears
Slab Shears
Squaring Shears
Steam Hydraulic Shears
Furnace Charging Equipment
Manipulators
Mill Tables
Flexible Couplings
Shear Gauges
Slab Scales
Cooling Beds
Transfers
Conveyors
Pushers
Buggies and Cars
Hot Saws

Cold Saws
Rack Annealing Beds
Annealing Boxes
Gear Drives
Cut and Machine Molded Iron and Steel Gears
Coilers
Coil Boxes
Pilers
Mesta Patented Feed Reels
Tension Reels
Belt Wrappers
Mesta Patented Sheet Chargers
Electrolytic Cleaning Lines
Mesta Patented Pickling Machines
Continuous Pickling Lines
Processors
Flash Welders
Trimmers and Slitters
Stitching Machines
Straightening Machines
Levellers
Scrap Ballers

ROLLS AND MILL PINIONS

Steel and Alloy Steel Rolls
Mesta Grain Rolls
Chilled and Sand Iron Rolls
"Mesta Special" Alloy Steel Rolls
Mesta Hardened Chill Rolls
Mesta Hardened Grain Rolls
Heat Treated Special Alloy Steel Rolls
Backing-Up Rolls
Forged Hardened Steel Rolls
Cut Tooth Mill Pinions
Machine Molded Mill Pinions

FORGINGS

Open Hearth and Electric Furnace Alloy and Carbon Steel

Large Shafts, Ship Shafts, Billets, Blooms, Piston Rods, Connecting Rods, Locomotive Axles, Reaction Towers, Air Bottles, Boiler Drums, Crankshafts and General Forgings

PRESSES AND EQUIPMENT

Hydraulic and Steam Hydraulic Forging, Bending, and Forming Presses
Large Power Presses
Intensifiers
Accumulators

SPECIAL MACHINE TOOLS

Heavy Duty Table-type Planers
Heavy Duty Post-type Planers
Heavy Duty Pit-type Planers
Heavy Duty Draw-Cut Shapers
Heavy Duty Boring Mills
Gear Planing Machines
Combination Shaping, Boring and Milling Machines
Heavy Duty Boring and Turning Lathes
Trepanning Lathes
Ingot Slicers
Roll Grinders
Roll Lathes
Gear Hobbing Machines

GAS AND STEAM ENGINES FOR BLAST FURNACES, ROLLING MILLS AND POWER PLANTS

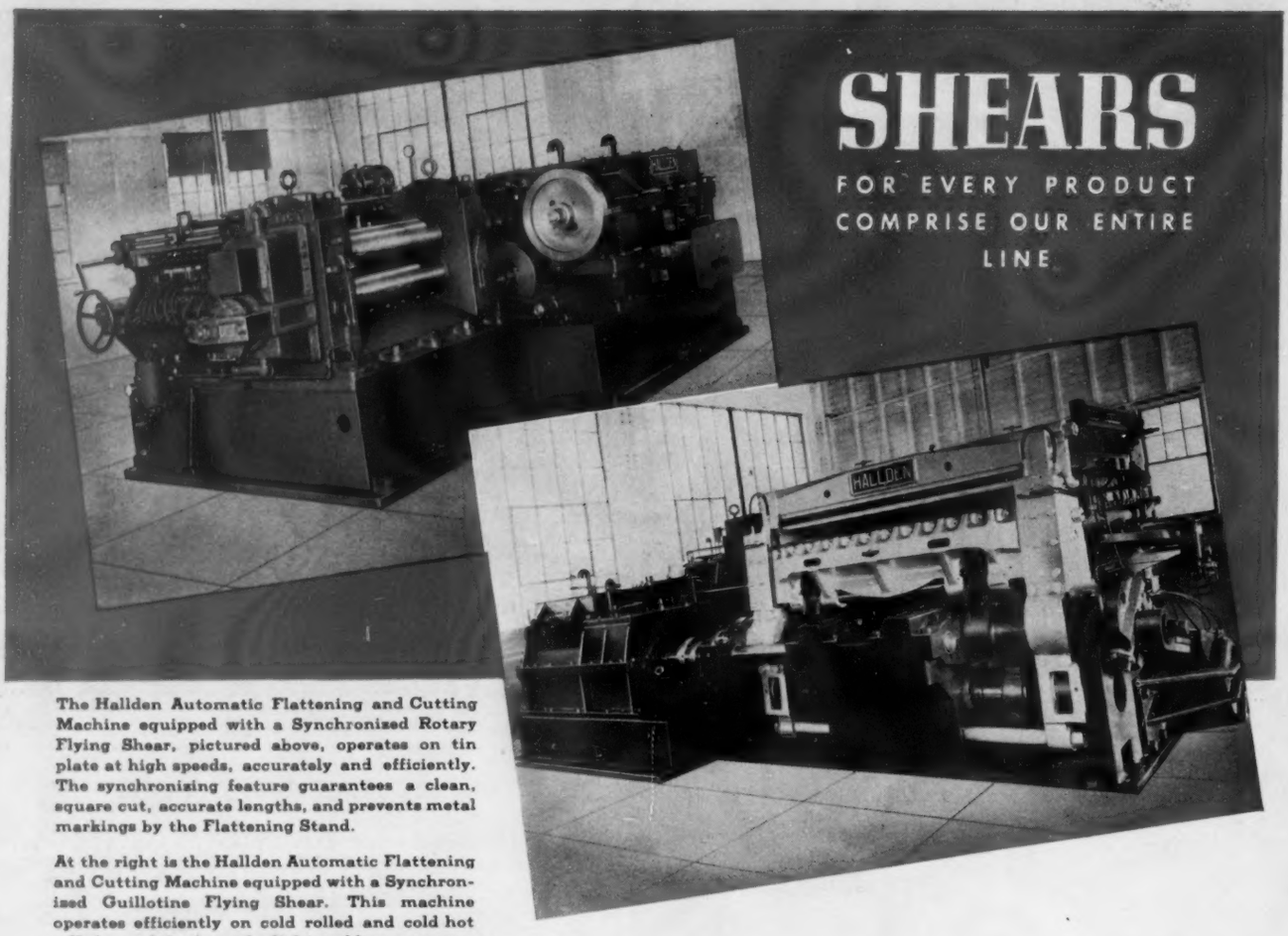
Una-Flow Engines (Stumpf Patents)
Piston and Corliss Valve Engines
Reversing Engines
Blowing Engines
Barometric Condensers
Air Heads
Air Compressors
Vacuum Pumps
Mesta Automatic Plate Valves (Iversen Patents)

CASTINGS

Acid Open Hearth, Carbon and Alloy Steel Castings and Forging Ingots, Air Furnace Iron Castings, Bronze Castings

MESTA MACHINE COMPANY, PITTSBURGH, PA.

SPECIALISTS



The Hallden Automatic Flattening and Cutting Machine equipped with a Synchronized Rotary Flying Shear, pictured above, operates on tin plate at high speeds, accurately and efficiently. The synchronizing feature guarantees a clean, square cut, accurate lengths, and prevents metal markings by the Flattening Stand.

At the right is the Hallden Automatic Flattening and Cutting Machine equipped with a Synchronized Guillotine Flying Shear. This machine operates efficiently on cold rolled and cold hot rolled metal, both on the light and heavy gauges.

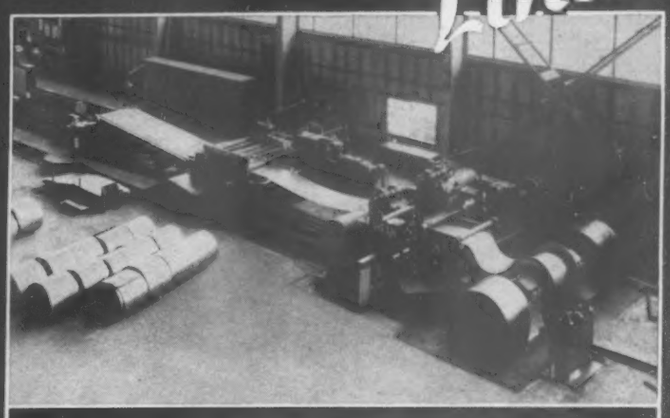
Specializing in one product exclusively has established Hallden as a leader in the manufacture of Flying Shears. Automatic levellers and shears for steel and nonferrous metals, shears for round, square or hexagon wire and shears for special applications are among the Hallden products. Consult us about your shear problems.

THE HALLDEN MACHINE CO.

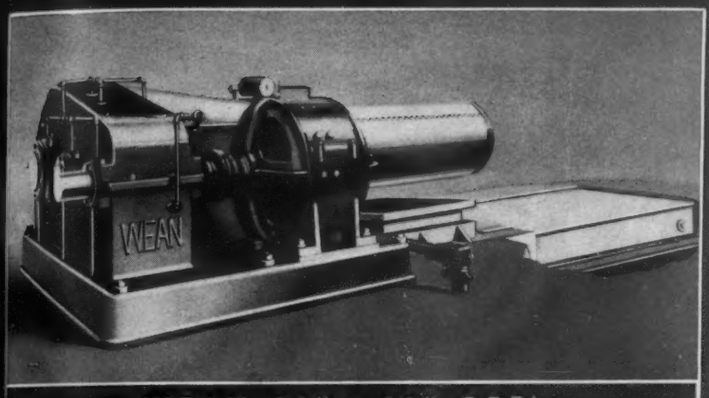
THOMASTON, CONN.

ASSOCIATED COMPANIES • THE WEAN ENGINEERING COMPANY, INC — WARREN, OHIO
• W. H. A. ROBERTSON & COMPANY, LTD — BEDFORD, ENGLAND

WEAN STRIP SHEARING *Lines*



WEAN HI-SPEED SHEARING LINE



WEAN 24" x 80" REEL

COMPLETE SIDE TRIMMING and SHEARING LINES for STRIP STEEL

THE WEAN ENGINEERING COMPANY

WARREN,

PRODUCTS

- Continuous Strip Coiling Equipment.
- Special Conveying Mechanism.
- Automatic Pilers
- Uncoiling Units.
- Press Feeding Equipment.
- Slitters.
- Strip Uncoiling and Automatic Shearing Units.
- Strip Coil Holders.
- Strip Coiling Reels.
- Sheet Galvanizing Equipment.
- Automatic Tinning Equipment.
- Automatic Doublers.
- Normalizing Furnaces.
- McKay Levellers and Processing Units.
- Strip Welding Equipment.
- Continuous Strip Pickling Equipment including: Uncoilers, Up-Cut Shears, Stitching Machines, Pinch Roll Units, Recoilers, Drying Machines, Pickling Tanks, and Auxiliary Equipment.
- Scrubbing, Leveling, and Oiling Machines for Flat Products.
- Wilson Vertical Tube Type Annealing Furnaces.
- Corrugated Inner Covers.
- Automatic Feeding and Catching Tables.
- Continuous Pack and Pair Heating Furnaces.
- Wheelabrator Abrasive Cleaning Equipment.
- Automatic Weight Classifier.
- Automatic Gauge Classifier.

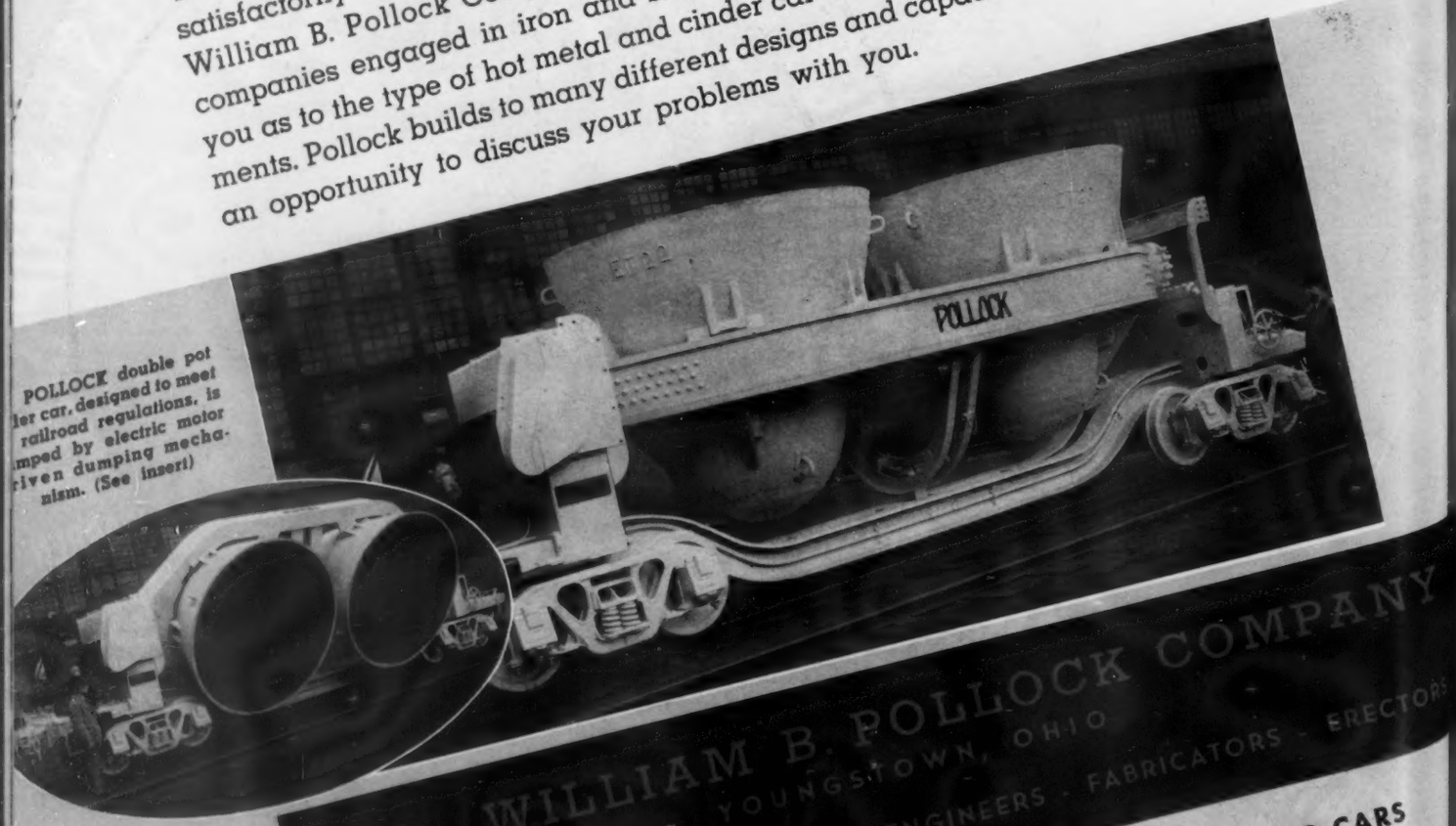
Associated Companies

LEE WILSON ENGINEERING Co. . Cleveland, O.
THE McKAY MACHINE COMPANY . Youngstown, O.
FLINN & DREFFEIN Co. . . . . Chicago, Ill.
THE HALLDEN MACHINE Co. . . . . Thomaston, Conn.
The WEAN ENGINEERING Co. of Canada, Ltd. . Hamilton, Ont.
The WELLMAN SMITH OWEN ENG. CORP., Ltd. . London, Eng.

POLLOCK heat retaining ladles can be lifted from the car and poured directly into the mixer—or dumped in the car itself. (See insert)

POLLOCK HOT METAL CARS & CINDER CARS

You must have up to date Hot Metal and Cinder handling equipment to satisfactorily operate Modern Blast Furnaces and Steel Plants. Because The William B. Pollock Company has had many years experience in serving companies engaged in iron and steel making, it is qualified to advise with you as to the type of hot metal and cinder car which best meets your requirements. Pollock builds to many different designs and capacities, and welcomes an opportunity to discuss your problems with you.



POLLOCK double pot ler car, designed to meet railroad regulations, is mped by electric motor riven dumping mecha- nism. (See insert)

The WILLIAM B. POLLOCK COMPANY

YOUNGSTOWN, OHIO

STEEL PLATE CONSTRUCTION • ENGINEERS • FABRICATORS • ERECTORS

BLAST FURNACES • HOT METAL CARS & LADLES • INGOT MOULD CARS
CINDER AND SLAG CARS • CHARGING BOX CARS
WELDED OPEN HEARTH LADLES
WELDED STEEL PRODUCTS

"NATIONAL" ROLL

We specialize in

ROLLING MILL MACHINERY

SPECIAL CHILLED ROLLS
SAND ROLLS

ROLLS

PLAIN CHILLED ROLLS
COLD ROLLS

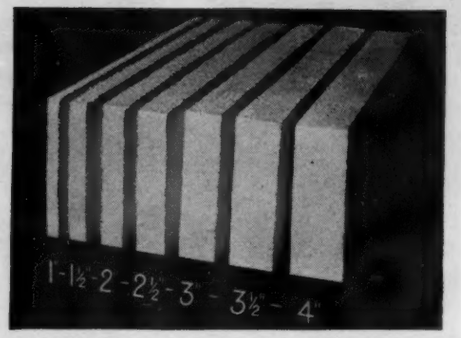
EXTRA HARD ALLOY ROLLS FOR BRASS, COPPER, ALUMINUM, ZINC

SPECIAL WORK ROLLS
FOR FOUR-HIGH MILLS

The National Roll & Foundry Company
Office and Works: AVONMORE, PA., U. S. A.

WHAT OTHER INSULATION GIVES YOU *ALL* THESE ADVANTAGES?

Standard throughout the steel and metal-working industries, J-M Superex has proved itself the most efficient, economical insulation for all types of high-temperature equipment . . . Check these money-saving features



NO WASTE . . . You can buy the exact thickness you need when you use Johns-Manville Superex. This modern material is available in the wide range of thicknesses shown above . . . and in any intermediate thickness you might want.

HIGH INSULATING EFFICIENCY . . . J-M Superex has an exceptionally low thermal conductivity, even at high temperatures. It is frequently possible to use 3 inches of this durable, efficient insulation in place of 4½ inches of other materials.

LOW INSTALLATION COSTS . . . Superex is supplied in large lightweight blocks that are easy to handle and install. As much as 3 sq. ft. can be applied in one unit. Think what this means in time and labor savings!

SAFETY AT HIGH TEMPERATURES . . . Made of asbestos and diatomaceous silica, H-T Superex has unusually high heat resistance. Thousands of installations in service up to 1900° F. prove its dependability and long life.

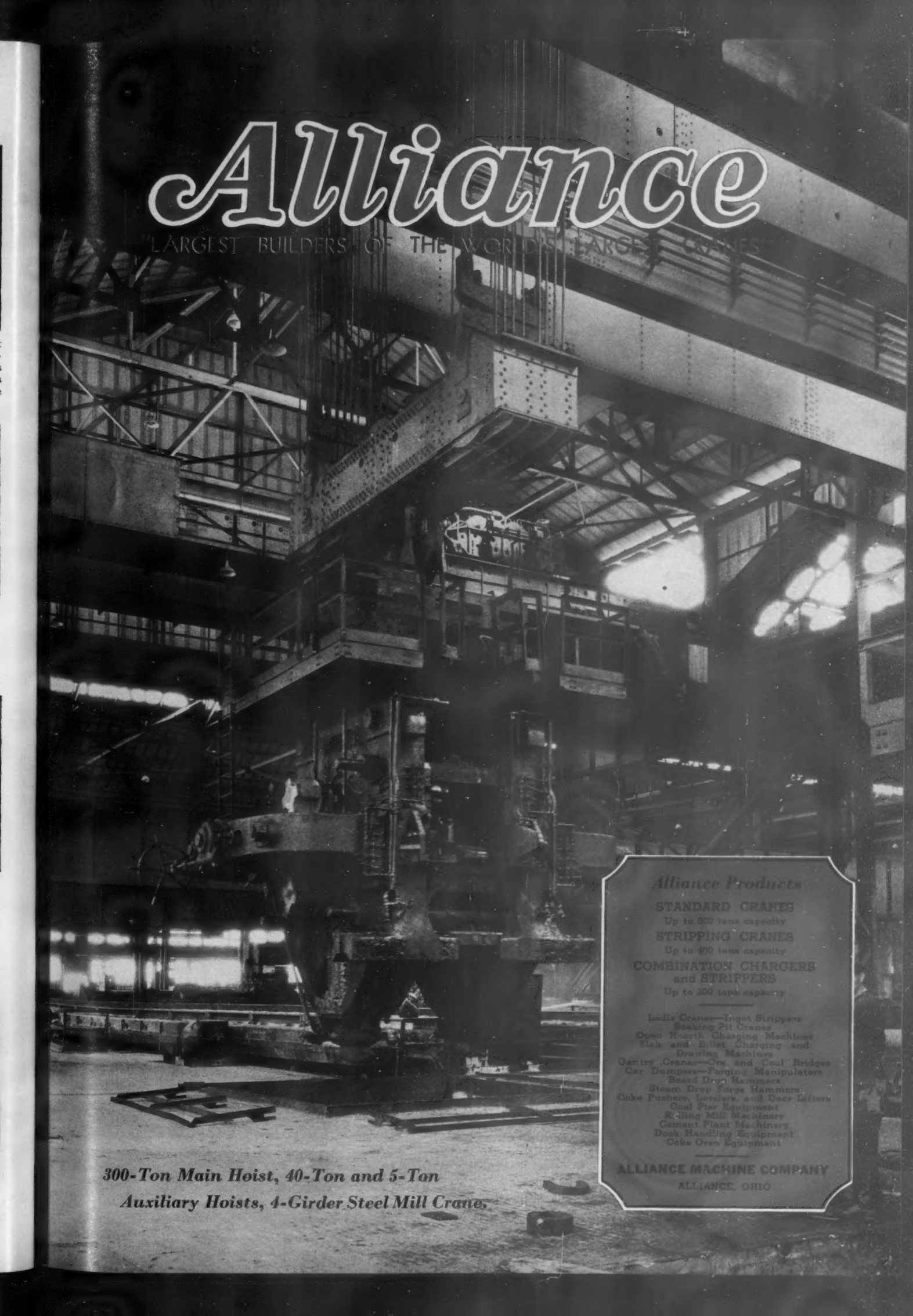
LESS HEAT LEAKAGE . . . Joint losses are a potential source of costly fuel waste. The large-size units in which Superex is supplied reduce the number of joints needed . . . keep such leakage at the absolute minimum.

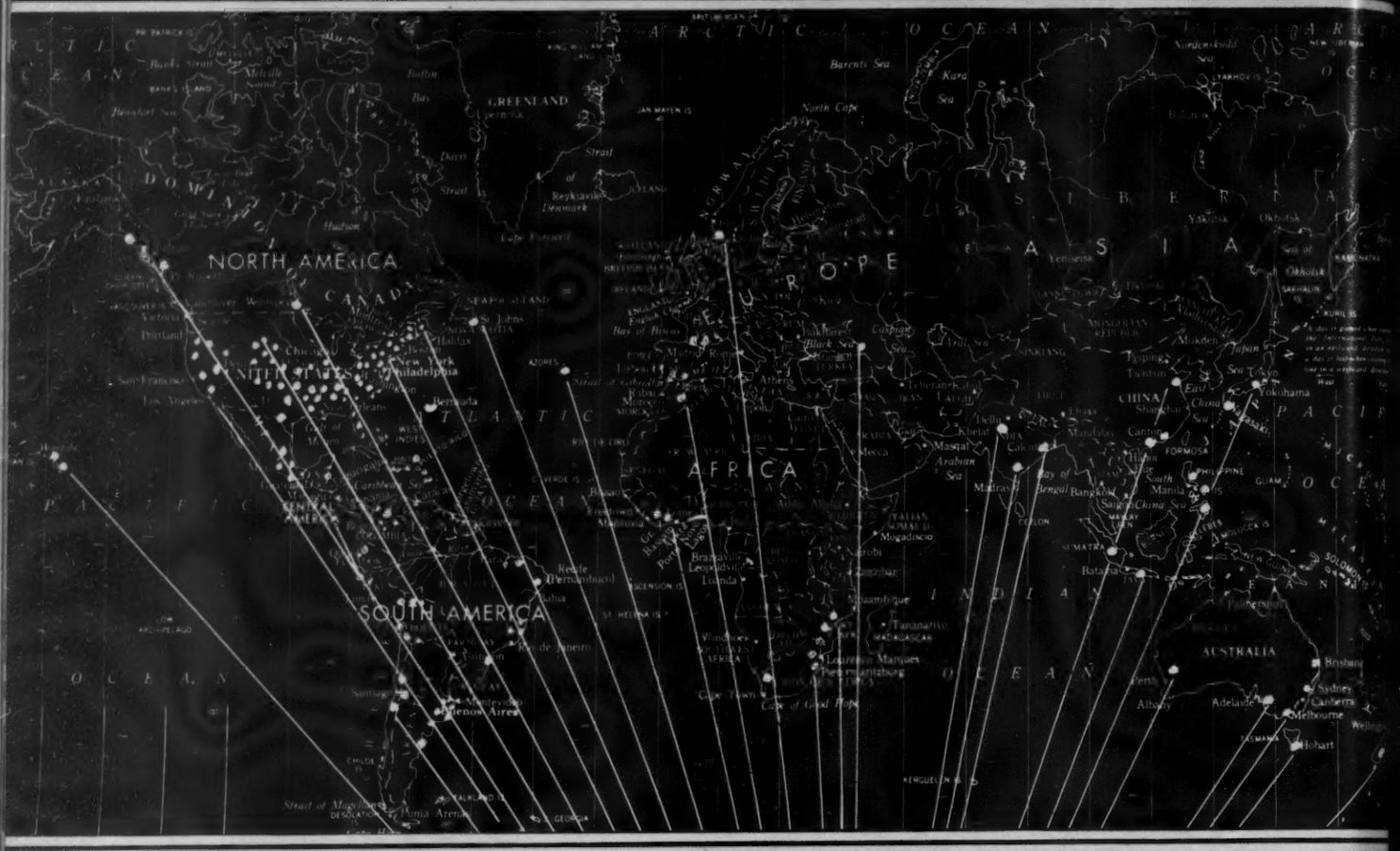
WHEREVER a block insulation is needed, you can't go wrong with J-M Superex. For over 15 years, it has been proving its superior efficiency and dependability for high-temperature service. You'll find Superex ideal for insulating all types of heated steel-mill and metal-working equipment. Furnished in two types: H-T Superex for temperatures to 1900° F.; L-W Superex for temperatures to 1500° F. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville INDUSTRIAL INSULATIONS

For every temperature . . . for every service condition

SUPEREX . . . 85% MAGNESIA . . . JM-20 BRICK . . . SIL-O-CEL C-22 BRICK . . . SIL-O-CEL NATURAL BRICK . . . J-M NO. 500 CEMENT . . . SIL-O-CEL C-3 CONCRETE . . . MARINITE

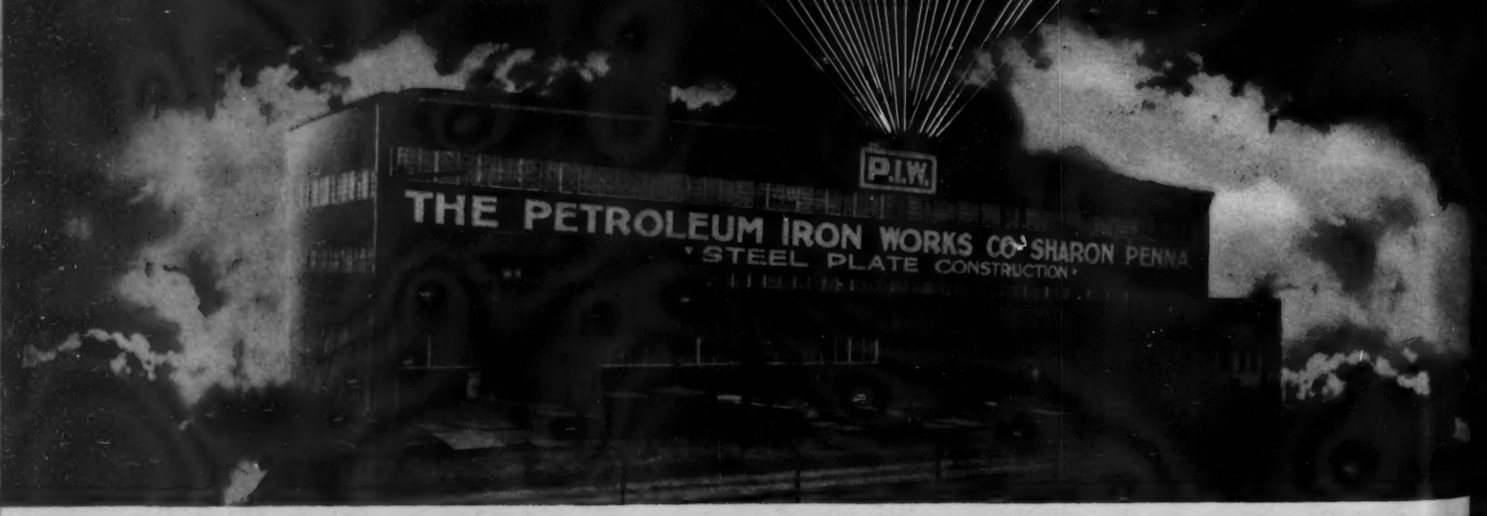

Alliance
LARGEST BUILDERS OF THE WORLD'S LARGEST CRANES
Alliance Products
STANDARD CRANES
Up to 500 tons capacity
STRIPPING CRANES
Up to 400 tons capacity
COMBINATION CHARGERS and STRIPPERS
Up to 200 tons capacity
Ladle Cranes—Ingot Strippers
Soaking Pit Cranes
Open Hearth Charging Machines
Slab and Billet Charging and Drawing Machines
Gantry Cranes—Ore and Coal Bridges
Car Dumpers—Forging Manipulators
Board Drop Hammers
Steam Drop Forge Hammers
Coke Pushers, Levelers, and Door Lifters
Coal Pier Equipment
Rolling Mill Machinery
Cement Plant Machinery
Dock Handling Equipment
Coke Oven Equipment
ALLIANCE MACHINE COMPANY
ALLIANCE, OHIO
300-Ton Main Hoist, 40-Ton and 5-Ton Auxiliary Hoists, 4-Girder Steel Mill Crane.



THE WORLD IS OUR MARKET

AS IS EVIDENCED BY OUR SHIPMENTS OF TANKS, DRUMS, PRESSURE VESSELS, WELDED PIPE, STACKS, FRACTIONATING COLUMNS, STEEL PLATE CONSTRUCTION

Wire • Write • Phone



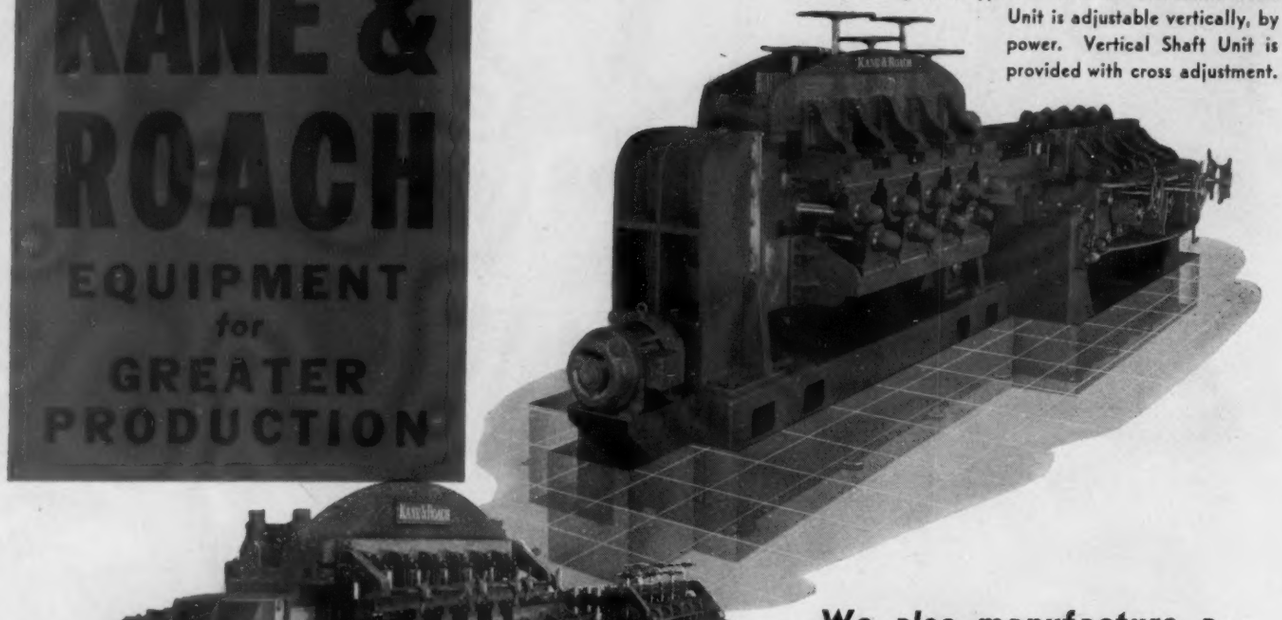
THE PETROLEUM

NEW YORK

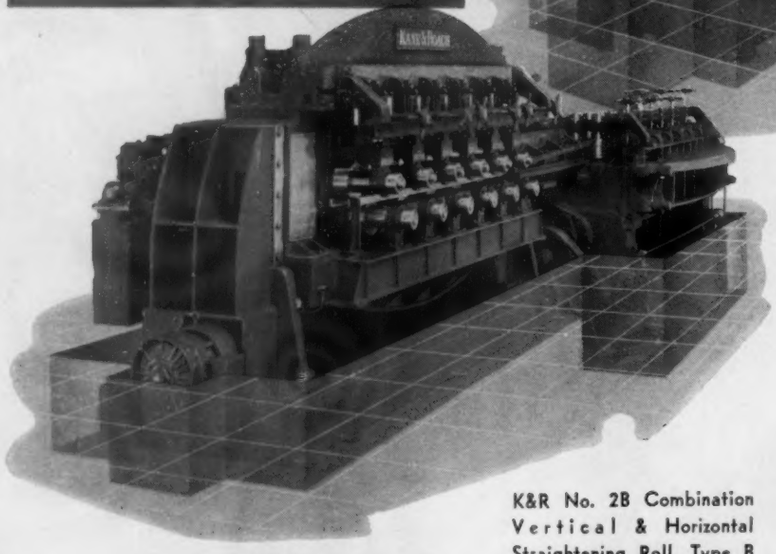
PIW
PTW
IRON WORKS CO.
GENERAL OFFICES: SHARON, PENNA

KANE & ROACH

EQUIPMENT for GREATER PRODUCTION



K&R No. 3AH Combination Vertical & Horizontal Straightening Roll, Type A—18 rolls. Horizontal Shaft Unit is adjustable vertically, by power. Vertical Shaft Unit is provided with cross adjustment.



K&R No. 2B Combination Vertical & Horizontal Straightening Roll, Type B —24 rolls. All rolls are adjustable longitudinally. All roll shafts are power driven. Horizontal Shaft Unit is adjustable vertically, by power. Vertical Shaft Unit is provided with cross adjustment.

We also manufacture a complete line of

BENDING ROLLS
COLD ROLL FORMING MACHINES
GANG SLITTERS
EDGING MACHINES
WIRE CRIMPERS
BULLDOZERS

K&R No. 3 11-roll Sheet Leveller.

K&R No. 5250-B Rotary Straightening Roll—5 rolls.

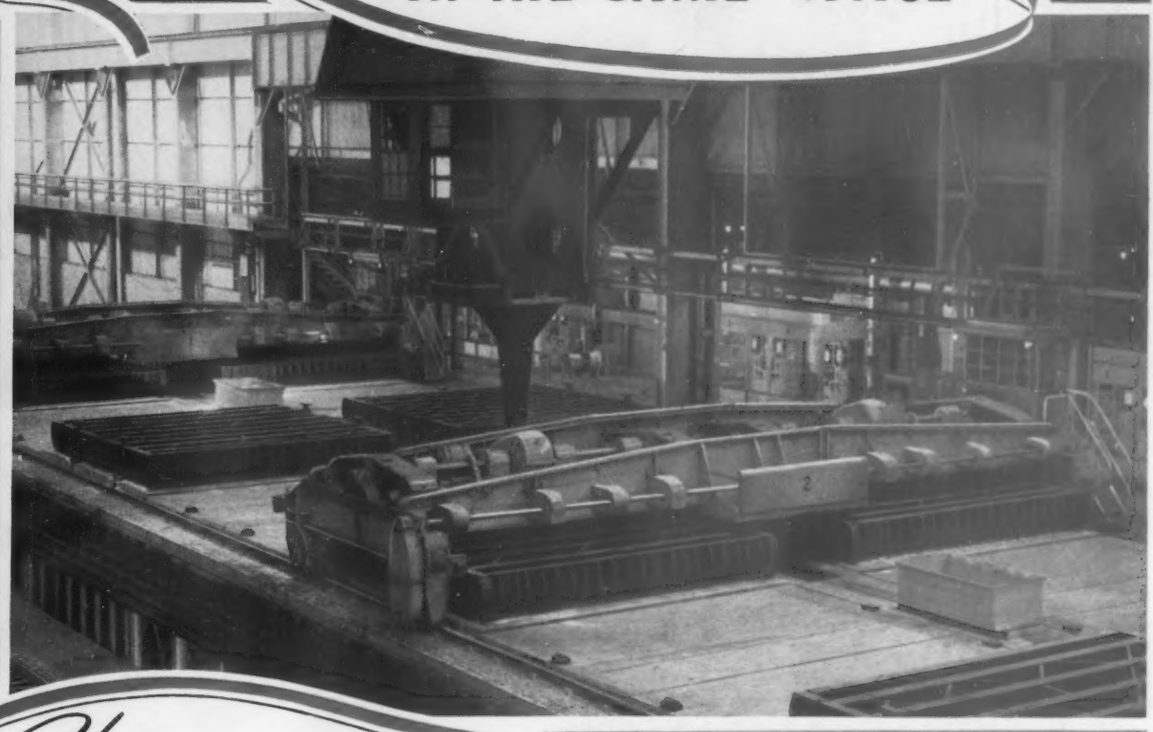
KANE & ROACH

INCORPORATED

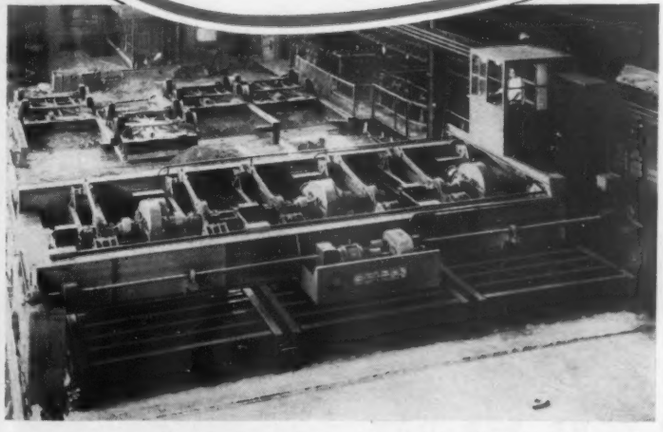
Syracuse, New York

Established 1887

100% GREATER PRODUCTION
IN THE SAME SPACE



The
AMCO
PIT FURNACE



AMCO PIT installations usually produce 100% greater heating capacity *in the same space* . . . a record typical of AMCO performance. In times like these, when increased industrial capacity is so essential, AMCO PIT FURNACES fittingly solve the problem, since they require no additional floor space! Moreover, AMCO PITS give increased tonnage with less fuel consumption and more uniform heating . . . *every heat alike, every ingot alike!*

Write for booklet, "HOW AMCO MEETS EVERY TEST IN INGOT HEATING."

The AMSLER-MORTON COMPANY
FULTON BUILDING • PITTSBURGH, PA.

HANLON-GREGORY GALVANIZING COMPANY

PITTSBURGH PENNSYLVANIA

A modern plant, with an organization and resources to meet industry's every need for Job Galvanizing (Zinc Coating) by the "Hot Dip" process.

World's Largest

Job Galvanizing Plant

CAPACITY—350 TONS PER DAY

LESS COST PER TON OF STEEL ROLLED rounds

The men who do the actual rolling in the mills can tell the story of roll performance as no one else can. Ask any mill man about Pittsburgh Rolls.

PITTSBURGH ROLLS

PITTSBURGH ROLLS DIVISION of BLAW-KNOX CO.—"Steel's Partner" • PITTSBURGH, PA.

this mill offered a number of features that were revolutionary. Put into production as a two-strand mill, the reheating furnace, roughing, intermediate and looping stands were designed for *four*-strand operation.

R 83

MORGAN
WORCESTER
ENGINEERS AND
MANUFACTURERS

MORGAN CONTINUOUS ROLLING MILLS

ROD • SKELP AND STRIP • BILLET • MERCHANT MILLS

MORGAN CONSTRUCTION COMPANY . . . . . Worcester, Massachusetts

DOUBLED IN 1940

Four-strand continuous production in wire rod required only the installation of a second finishing train, coiling and conveying equipment.

Looking ahead is a Morgan habit. Morgan looked ahead 50 years ago—and many of their early mills are still in operation. Morgan looked ahead in 1932 and produced the first four-strand mill for a steel plant in England. Yes—Morgan is prepared for Preparedness.

"SALEM" is prepared for defense!

The WITTER PROCESS FOR FORGING SHELLS

- SAVINGS IN MATERIAL
- SPEED OF PRODUCTION
- HIGH QUALITY
- LOW OPERATING COST
- SMALL FLOOR SPACE REQUIREMENTS
- MINIMUM MAINTENANCE COST

Complete Equipment for SMALL ARMS AMMUNITION

ANNEALING, PICKLING, WASHING & DRYING SMALL ARMS COMPONENTS - FULLY AUTOMATIC - MATERIAL NOT HANDLED BETWEEN CHARGING AT ANNEALING FURNACE AND DISCHARGING AT DRYER - UP TO 50 CALIBER CARTRIDGE CASES EQUIPMENT FOR ANY BRASS DEEP DRAWING OPERATION

Consultants - Engineers - Builders

COMPLETE ORDNANCE PLANTS

And Special Forging Plants

These specialized "Salem" Services are vitally important to the production of Ordnance and Small Arms Ammunition and are backed by complete technical and operating experience.

ROTARY HEARTH FORGING FURNACES
BATCH TYPE FORGING FURNACES
ROTARY END HEATING FURNACES
BOX TYPE END HEATING FURNACES
HARDENING, QUENCHING, and DRAWING EQUIPMENT

HEAT TREATING EQUIPMENT, FOR AIRCRAFT PARTS

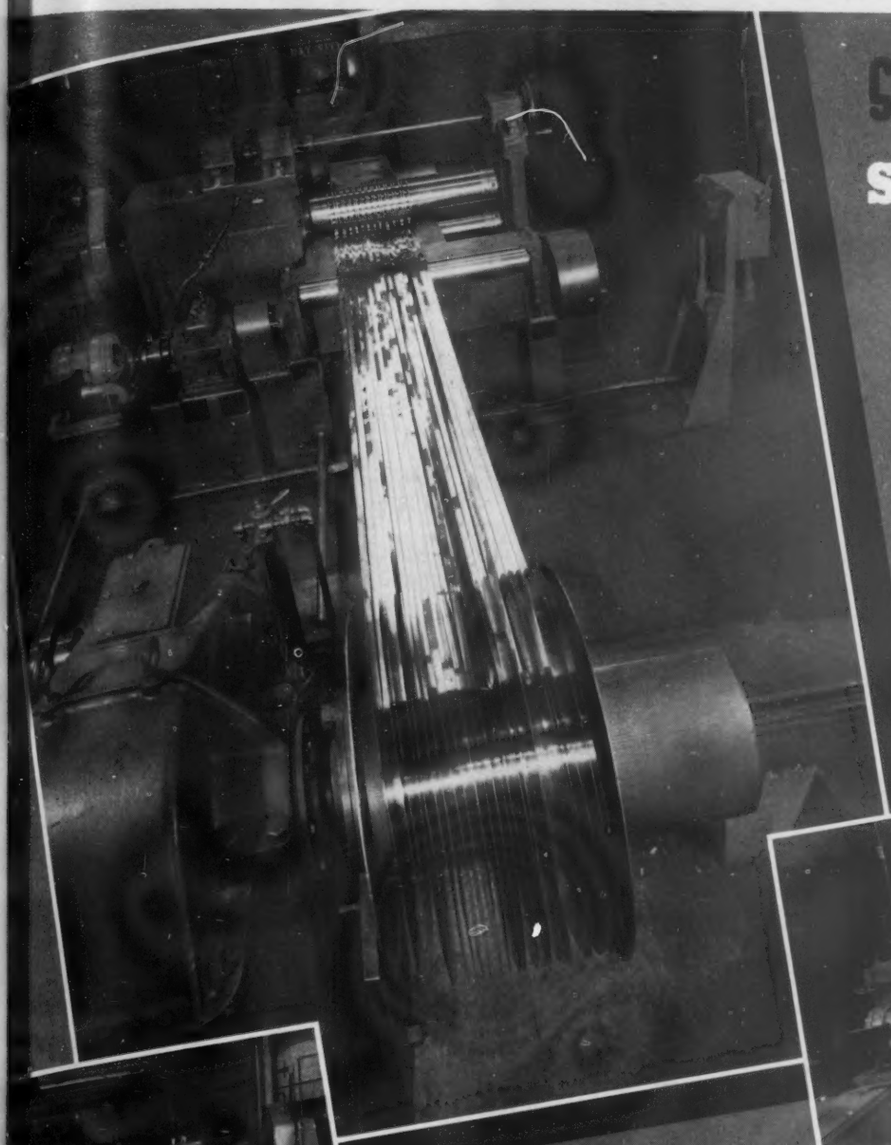
"Salem" designs, contracts, builds and offers consulting service.

All "Salem" Ordnance and Small Arms Equipment is readily adaptable to commercial production—in many cases without modification.

SALEM, OHIO.

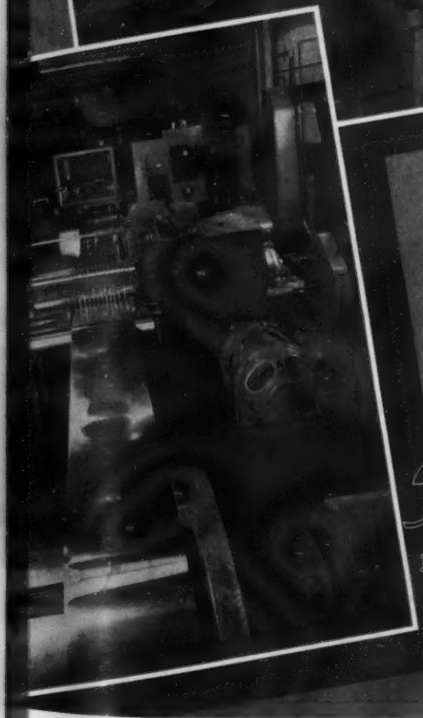
CHICAGO - DETROIT - PITTSBURGH
PHILADELPHIA - LONDON - PARIS
WELLAND, ONTARIO

SALEM ENGINEERING COMPANY



STAMCO *Presents a* SLITTING LINE *for* STRIP STEEL

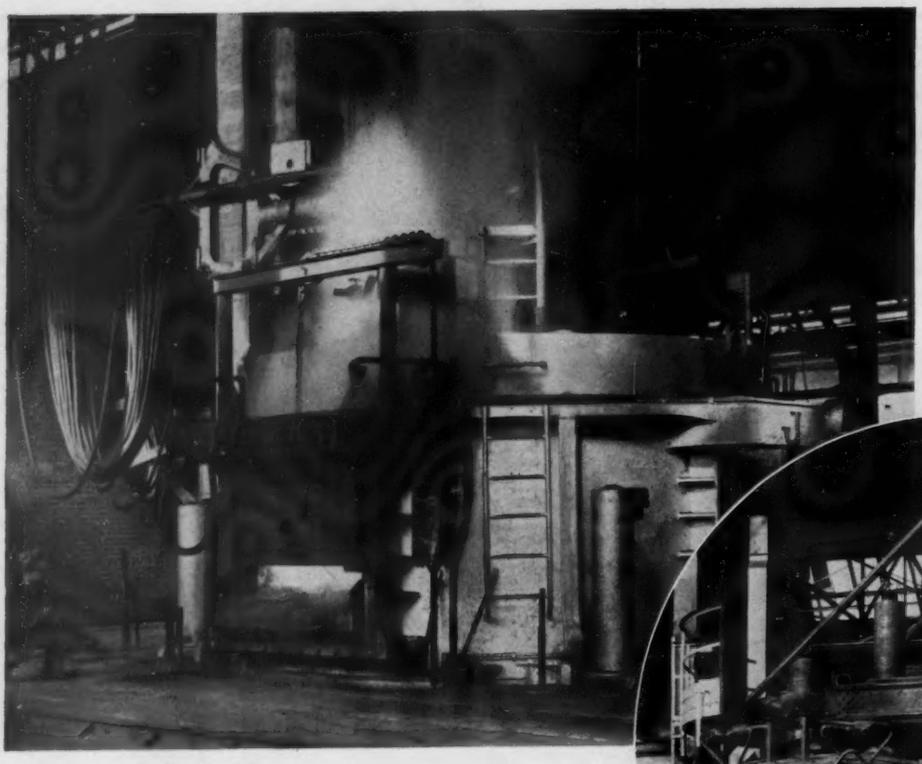
Designed and built by STAMCO for the steel and metalworking industries, this modern Slitting Line and its complete controls performs a quick, highly accurate slitting job on strip steel . . . Cutters on the unit proper and separation discs on the power driven reel are adjustable to accommodate up to 26 cuts on a given width. Operating speeds up to 600 feet per minute may be obtained . . . Complete construction and operating details are available to those interested.

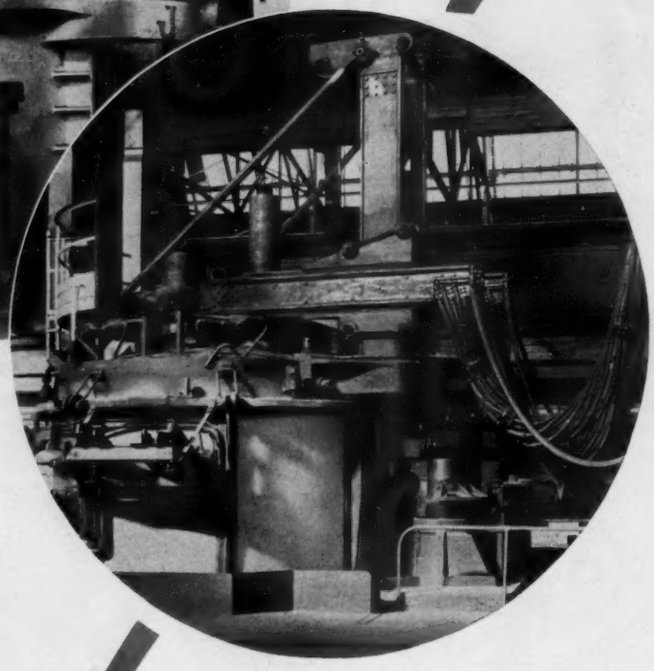


The STREINE TOOL & MANUFACTURING COMPANY

DESIGNERS AND BUILDERS OF STAMCO SHEET AND PLATE MACHINERY

NEW BREMEN, OHIO



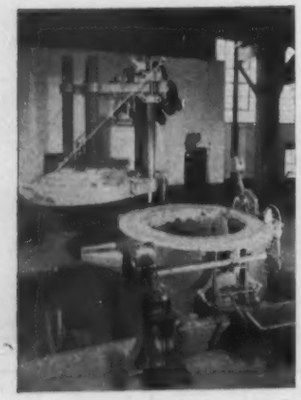


Above—A recently installed 70 ton capacity LECTROMELT furnace working on alloy steels. A second LECTROMELT furnace of the same capacity is now installed alongside the furnace illustrated.

Right—This illustration shows a side view of a 40 ton capacity LECTROMELT furnace of the top charge type.

Bottom—This view shows a 6 ton capacity top charge type LECTROMELT furnace with roof raised and rotated to one side to permit rapid charging by means of drop bottom charging bucket.

Moore Rapid Lectromelt Furnaces



We now have under construction the two largest top charge type furnaces in the Western Hemisphere. These units will be installed within the next few months.

LECTROMELT furnaces are built in standard sizes from 100 tons down to 25 lbs. capacity. Furnaces available for top charging, machine charging or chute charging as may be preferred.

With the top charge type LECTROMELT furnace there are worthwhile savings in power, electrodes, refractories and man hours. LECTROMELT furnaces are ruggedly built to give long service with lowest maintenance.

PITTSBURGH LECTROMELT FURNACE CORP.

PITTSBURGH, PA.

Associate Canadian Company
LECTROMELT FURNACES OF CANADA
TORONTO

Associate British Company
BIRMINGHAM ELECTRIC FURNACES, LTD.
BIRMINGHAM, ENGLAND

TO MAKE PRODUCTION PRODUCE PROFIT

consult with **YODER**

Yoder Slitting Lines handle widths up to 120".

The Yoder Electric Weld Tube Mill welds standard pipe from ⅛" up by the resistance method.

IS your production increasing? *Is your profit curve keeping pace?* Install metal-forming equipment by Yoder, and you go far toward answering the second question affirmatively.

The Yoder Electric Weld Tube Mill affords great visibility (no stooping or "peeping"), to help reduce scrap. It gives softer, more ductile welds in high carbon and other hard steels. It enables you to weld metals hitherto impossible. These and similar advantages spring from an experience which covers the entire tube-making field.

The Yoder Slitting Line is soundly engineered. The uncoiler may be either drum or cradle type. The slitter has anti-friction bearings throughout, enclosed gears heat-treated and running in oil, shafts hardened and ground. The uncoiler may be manually or automatically operated. These units are furnished with spindle diameters up to 12".

The Yoder staff plans, designs, erects, and *guarantees* every installation. That your production may produce *greater* profit, consult with Yoder.

Also — roll forming machines . . . automatic cut-off saws . . . rotary shears . . . power hammers . . . bending machines . . . edge-conditioning machines . . . brake shoe machines . . . special metal-working machinery.

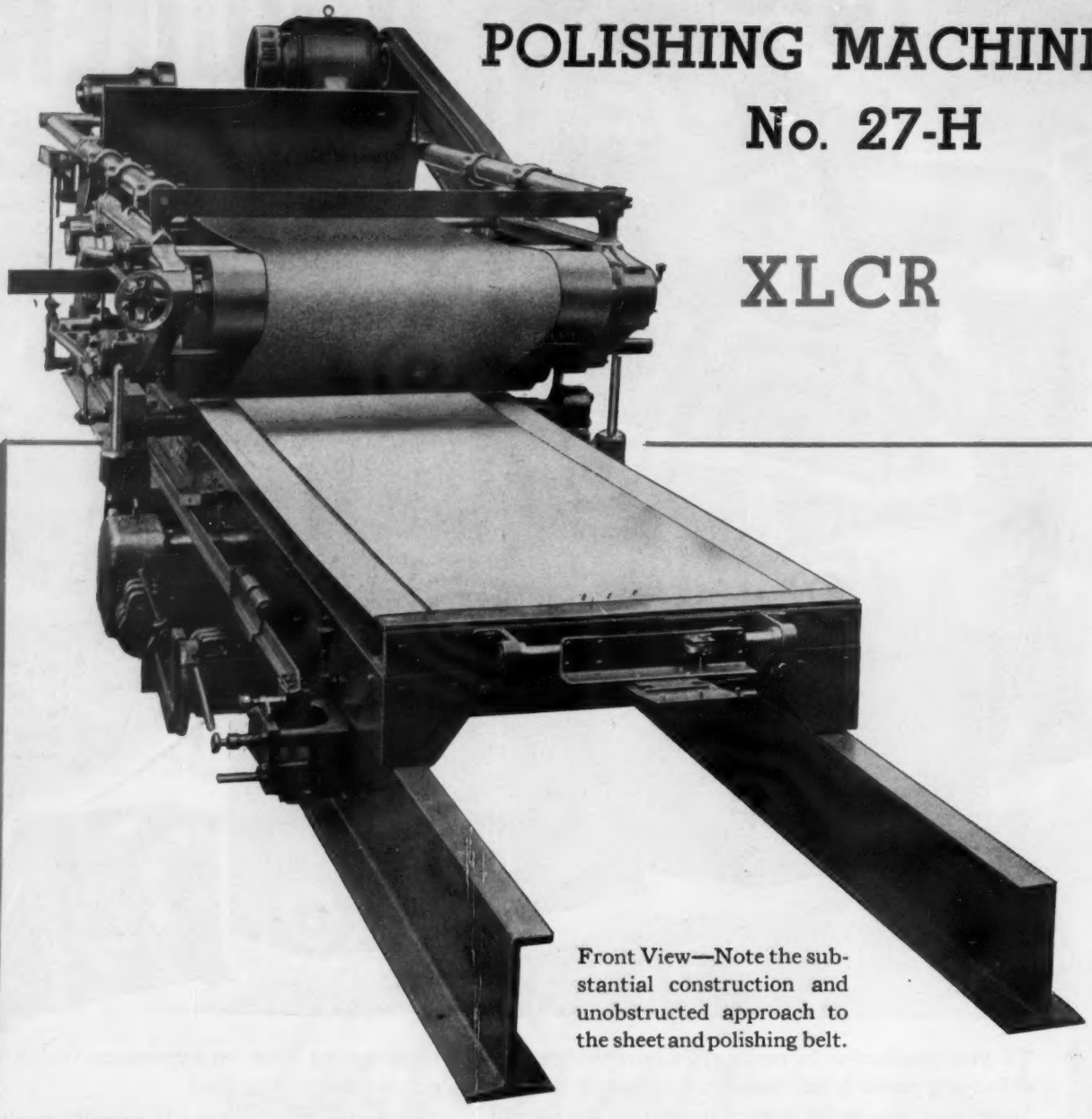
THE YODER COMPANY
WEST 55th STREET AND WALWORTH AVENUE
CLEVELAND, OHIO

METAL FORMING EQUIPMENT *by* YODER

EXCELSIOR STAINLESS STEEL SHEET POLISHING MACHINE

No. 27-H

XLCR



Front View—Note the substantial construction and unobstructed approach to the sheet and polishing belt.

Stainless Steel Sheets Polished by Our Simplified Process, Eliminates Excessive Inventory and Delay

● **One Manufacturing Plant paid for the entire equipment in 8 months by saving the extra polishing cost previously paid for polished sheets.** ●

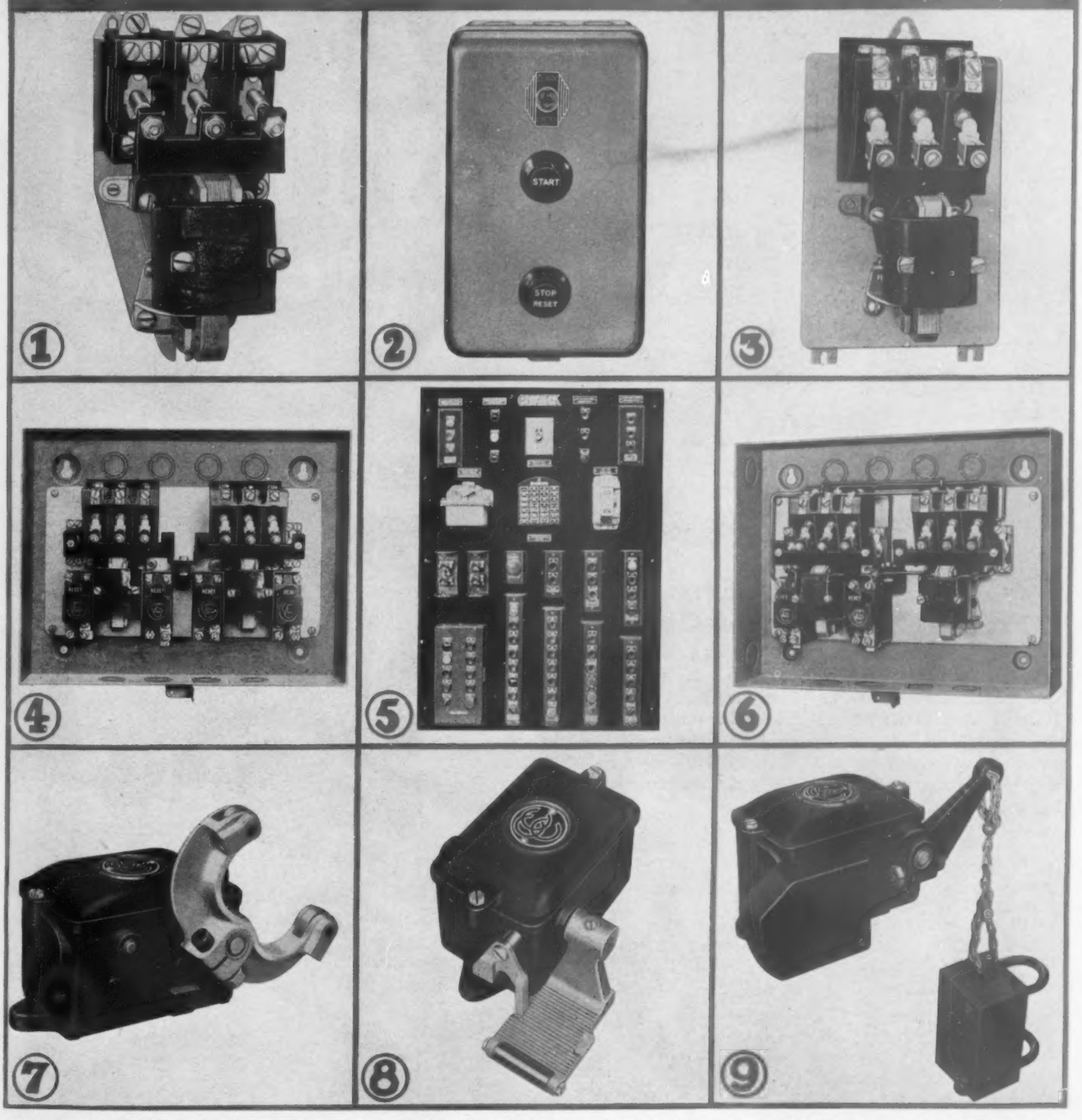
The Equipment requires no expert attention, is dustless and can be operated in any Assembling Plant by unskilled labor and has a capacity to produce a profit from $100.00 to $150.00 polishing sheets of the same dimensions and finish in 8 hours compared with the present price of polished sheets.

EXCELSIOR TOOL & MACHINE CO.

EAST ST. LOUIS, ILLINOIS

Some "3C" 1940 Major Developments

EMBODYING TRADITIONAL CLARK ENGINEERING AND CONSTRUCTION FEATURES



1. Bulletin 7305 Relays for Heavy Duty A.C. or D.C. Service.
2. Bulletin 6013, Sizes DS-0 or DS-1, Across-the-Line Starters.
3. Bulletin 7707 Contactors for standard or Heavy Duty applications.
4. Bulletin 6050, A.C. Automatic, Multi-Speed Across-the-Line Starters.
5. Bulletin 100, Type "D" Heavy Duty Push Button Stations.
6. Bulletin 6030 A.C. Automatic, Reversing Across-the-Line Starters.
7. Bulletin 102 Snap Action Track Limit Switches with Roller Fork Lever. Other type levers available.
8. Bulletin 101 Foot-Operated Heavy Duty Master Switches.
9. Bulletin 102, Pilot Circuit Crane Hoist Type Limit Switch.

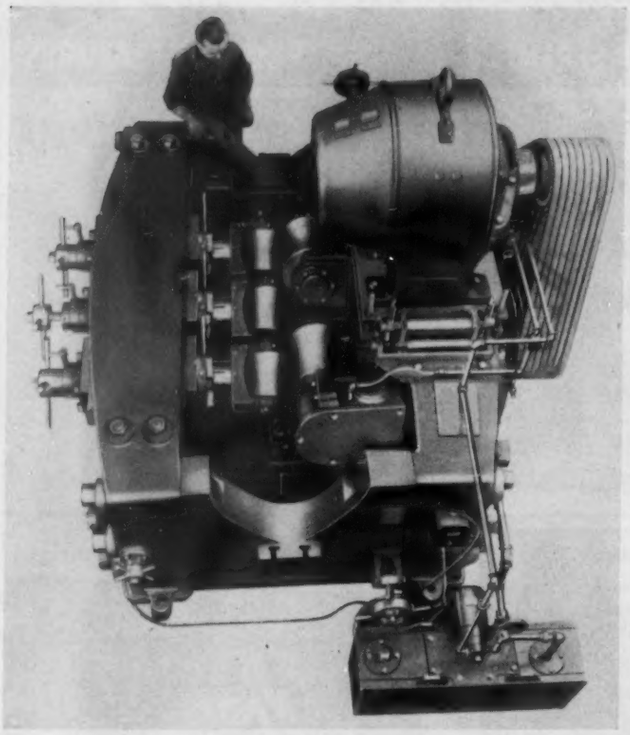
WRITE FOR FULLY DESCRIPTIVE BULLETINS.

CONTINUE TO ROLL WITH CLARK CONTROL

THE CLARK CONTROLLER CO.

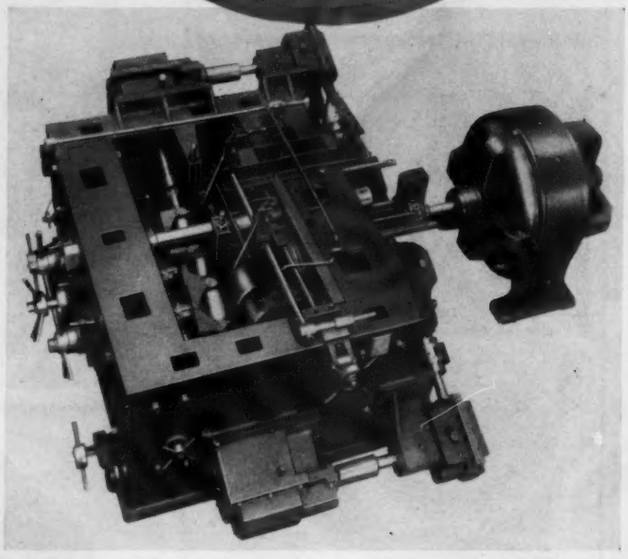
1146 EAST 152ND ST. CLEVELAND, OHIO

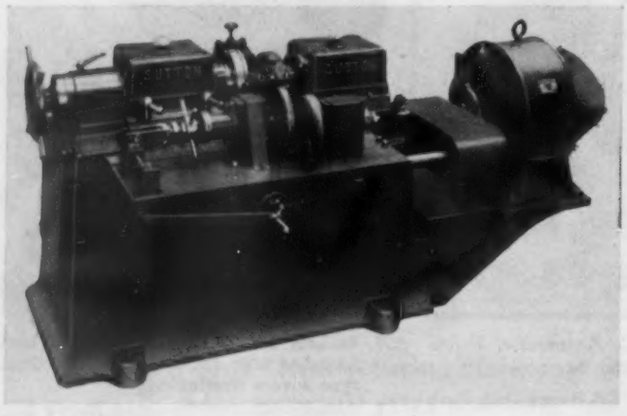
New SUTTON MACHINES



2BM STRAIGHTENER AND 1½B SIZING MACHINE

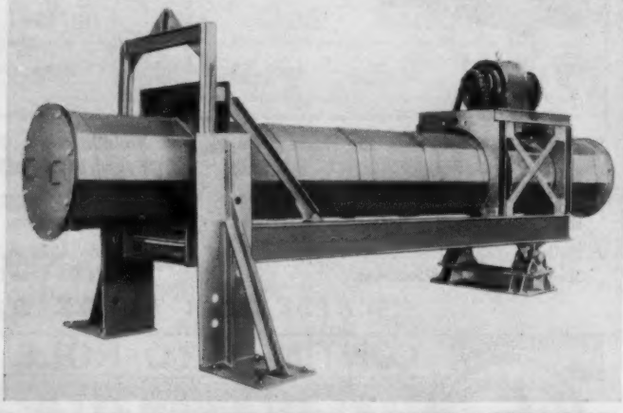
These machines, like other SUTTON units, are too bulky to send out on trial; however, many clients take advantage of our offer to demonstrate at our plant. Illustrated above is our No. 2 B M machine; this is being used extensively on the new continuous butt weld mills, finding increasing favor with use. Illustrated at the right is our 1½ B heavy duty 4-roll driven sizing machine; micrometer dial screw-downs aid materially in developing amazing accuracy.





POLISHER . . . Above is a cut of our improved polisher. Its disc polishing action produces a high lustre on ferrous and nonferrous rods. When specifications call for particularly fine polish, the SUTTON POLISHER delivers the stock mirror-smooth every inch of its length.

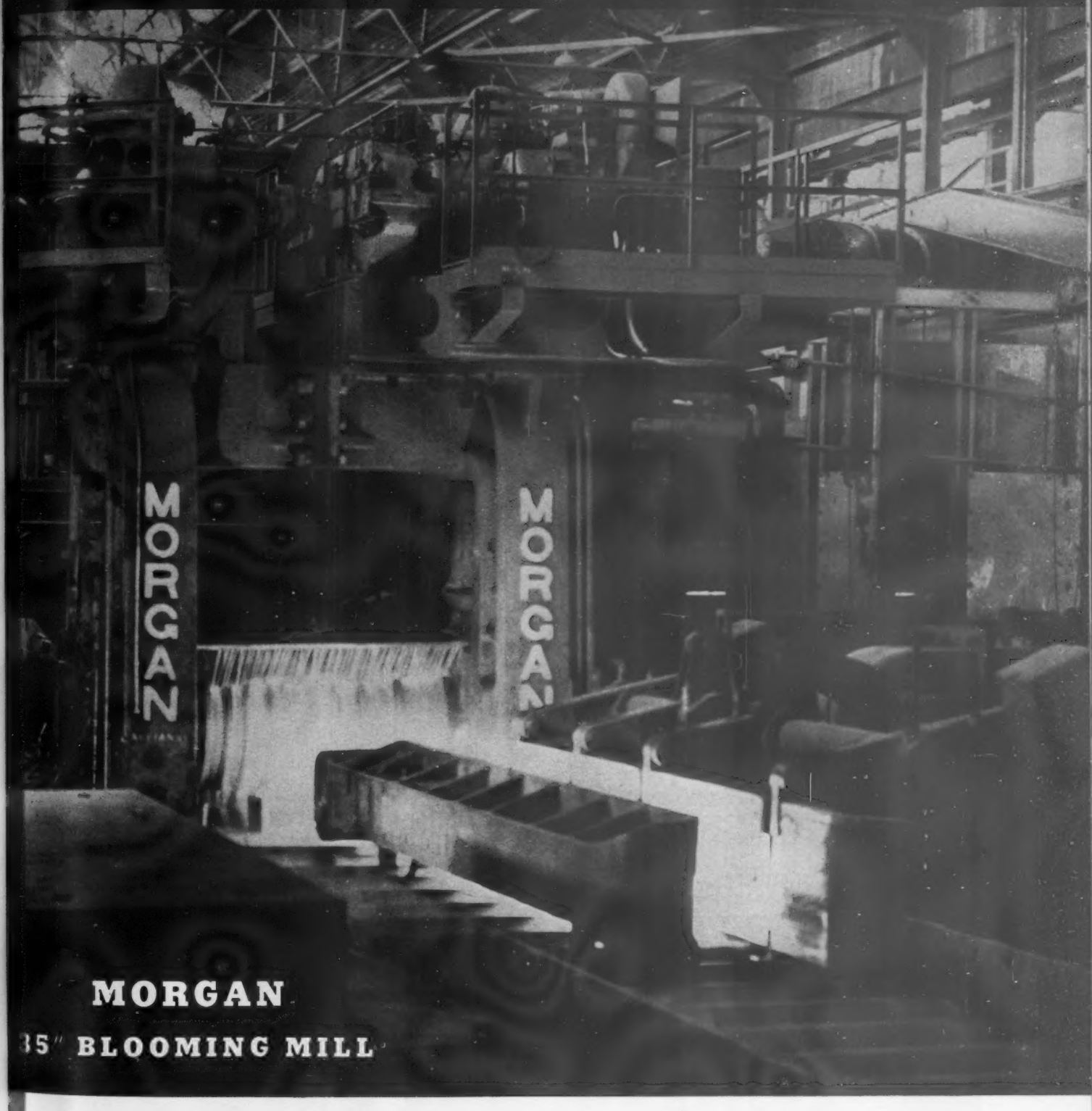
DESCALER . . . Pictured below is the SUTTON ROTARY DESCALER and CLEANER. It can remove rust and loose scale from any hot rolled bar section manufactured, as well as from all structural shapes and narrow plates. It is also serviceable in applying paint or rust proof coatings.



SUTTON ENGINEERING CO., PARK BLDG., PITTSBURGH

WE ALSO OFFER OUR COMPLETE AUTOMATIC UNIT TO STRAIGHTEN AND SIZE RODS FROM COILS

BUILT BY MORGAN *Engineering*



MORGAN
35" BLOOMING MILL

ABOVE is shown a Morgan 35" two-high blooming mill complete with double manipulator, front and rear tables. A hydraulic roll changing device is provided. Housings are one-piece steel castings of the closed top type. Top roll balance is of the counterweight type.

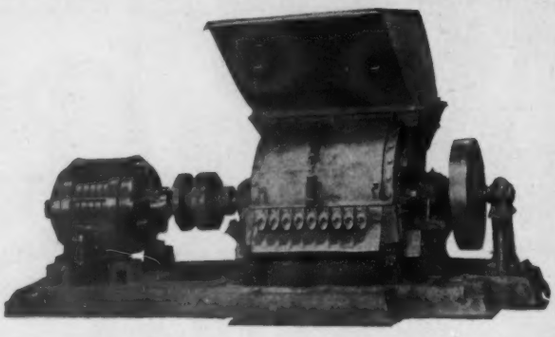
Manipulator is of the overhead type, compact and accessible. Tables are of heavy design, equipped with anti-friction bearings. Screw-down drive is arranged to provide crane hook access when changing guides. Provision is made for automatic lubrication and exclusion of scale and dirt.

★ **DESIGNERS • MANUFACTURERS • CONTRACTORS**
BLOOMING MILLS • PLATE MILLS • STRUCTURAL MILLS
★ ELECTRIC TRAVELING CRANES • CHARGING MACHINES
INGOT STRIPPING MACHINES • SOAKING PIT CRANES
★ ELECTRIC WELDED FABRICATION • LADLE CRANES
STEAM HAMMERS • STEAM HYDRAULIC FORGING
PRESSES • SPECIAL MACHINERY FOR STEEL MILLS
★

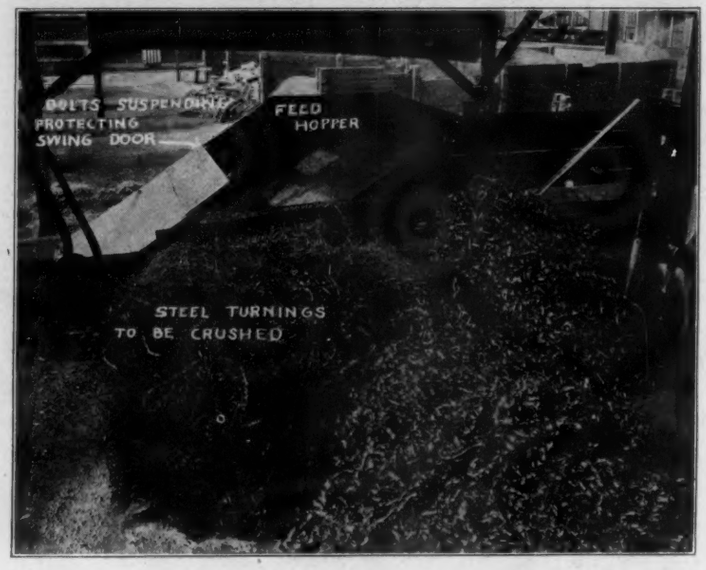
THE MORGAN ENGINEERING CO., Alliance, Ohio

★ *Pittsburgh, 1420 Oliver Building*

BIG RETURNS
ON A SMALL INVESTMENT



No. 3800 American Steel Turnings Crusher with hopper mounted on bed plate. (Patented)



Feed Platform with Steel Turnings

Many shops and manufacturing plants are making extra profits by crushing their turnings into chips with **AMERICAN RING STEEL TURNINGS CRUSHERS.** Chips not only bring a higher price but are easier to handle, require less storage space and are easier to ship.

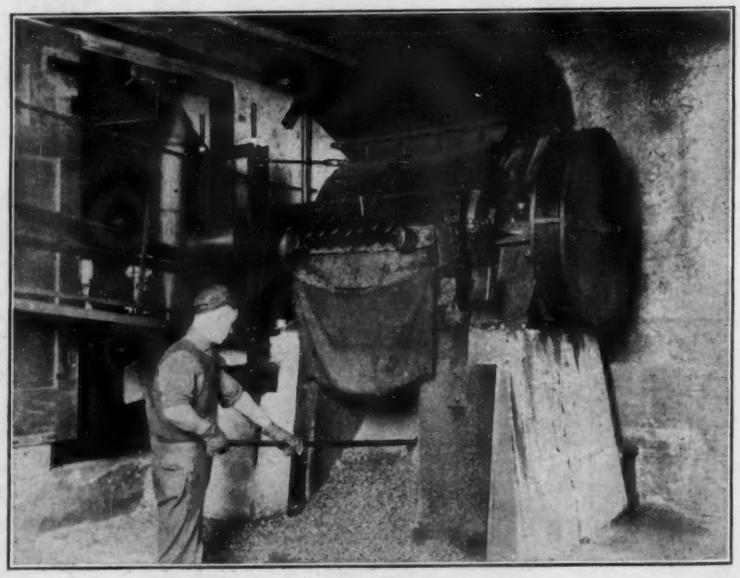
Your long turnings will cease to be a nuisance after you put an **AMERICAN RING CRUSHER** on the job. It will pay for itself in a very short time after which it will pay you a steady profit.

Do you want this **EXTRA** profit?

Write us for full particulars.

American Ring Crushers are crushing run of mine coal to stoker size at maintenance cost as low as 1/10 of a cent a ton

We manufacture a complete line of reduction equipment. Put your problems up to us.



A Typical Installation

ORIGINATORS OF THE ROLLING RING CRUSHER PRINCIPLE

AMERICAN PULVERIZER CO.

1539 Macklind Ave. St. Louis, Mo.

How We Took Care of The Future When We Planned for Defense

WE NEEDED A MACHINE FOR HONING GUN TUBES BUT COULDN'T USE IT FULL TIME WHEN FINISHED WITH OUR CONTRACT . . . HERE'S HOW THE BORE-HONE SOLVED OUR PROBLEM:

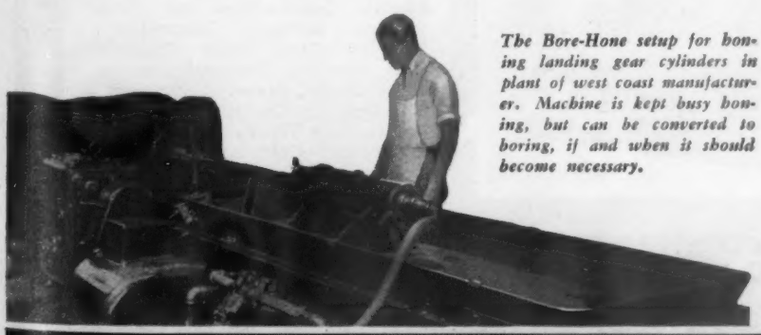
MUCH of our regular machining during normal business periods includes odd lot cylinder boring, drilling—occasional honing. These parts were usually routed over our standard boring and drilling machines—the honing was let out to jobbing shops. With this new machine, we can handle these cylinders and all of the operations in our own plant. We can both bore and hone in the same floor space with the same operator. This leaves our standard machines for full time boring on the larger castings for which they are better suited.

SEVERAL WAYS TO SAVE AND PROFIT

This versatility in boring set-ups, plus honing, is going to eliminate some handling time because we won't have to haul the parts from a boring machine to a honing machine. We'll save the time lost in sending the cylinders outside for honing.

We'll save the investment required for two machines because this one both bores and hones, and costs but little more than a machine capable of only one of these operations. We'll save the floor space of a complete machine, and be able to write off our machine investment with or without a defense contract. We'll hone gun tubes as long as they are needed and, when finished with this work, we will still have a versatile and profitable machine.

Your problem may be different. You may want to drill, bore, and hone airplane crankshafts. You may have enough work to keep a honing machine busy full time. You may want to increase your cylinder boring facilities. But, whatever your needs, a safe investment for defense work of this nature is the Bore-Hone, the machine that both bores and hones. Write for descriptive booklet today.

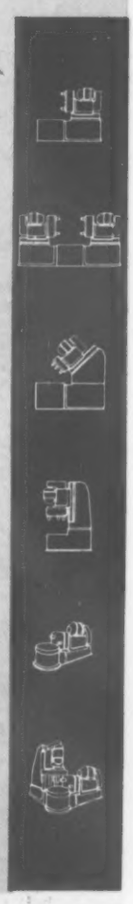


The Bore-Hone setup for honing landing gear cylinders in plant of west coast manufacturer. Machine is kept busy honing, but can be converted to boring, if and when it should become necessary.

UNIT TYPE MACHINE TOOLS FOR TODAY *AND TOMORROW*

SPECIAL machine tools designed from standard units are often readily retooled to accommodate part design changes. This saves the feed and drive units in addition to the machine beds. When used for defense contract work they provide production possibilities of equipment used in straight line mass production methods, while flexible enough to be adapted to regular machining requirements, should defense demands end. They are the most practical investment in special machine tools.

Some of the unit type machines designed and built by us for ordnance and defense work include single and multi-spindle deep hole drillers, trunnion turning machines for anti-aircraft gun cradles, rifle barrel reaming machines, indexing machines for the brass shell cases of light artillery and various production type machines for drilling, boring and tapping various components of airplane engines—both radial and straight-in-line types. We will be glad to furnish additional information in response to bonafide inquiries. All inquiries handled in confidence.



W. F. AND JOHN BARNES COMPANY • ROCKFORD, ILLINOIS

ATLAS SCALE CARS AND TRANSFERS

assure lowest haulage costs

Atlas Transfers Used in Ore Yard and at Unloading Dock

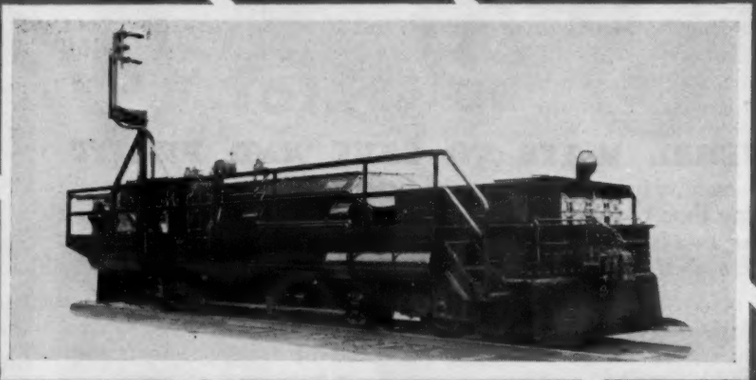
100 TON—CABLE BOTTOM DUMP TRANSFER CARS

6-Wheel Wood Frame trucks provided with anti-friction self-aligning bearings

Motor-driven discharge gates operated independently on each side of car

Elevated operators cab for observation of loading and car operation

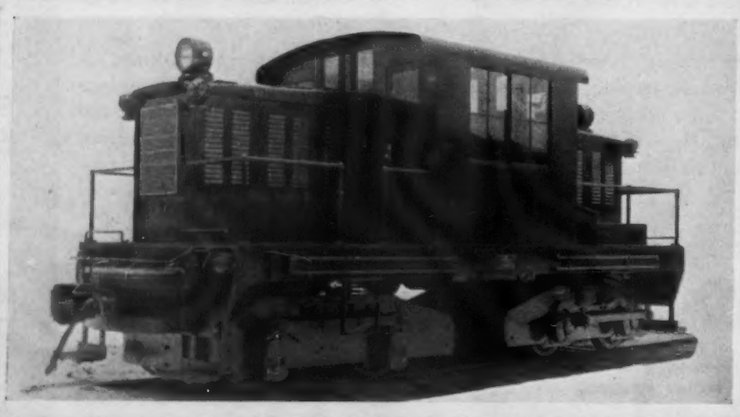
Discharge gates and bottom of hopper plates provided with electrically operated heaters to prevent freezing of materials in cold weather.



Accurate Weighing of Burdens Recorded on Direct-Reading Tape is Accomplished with Atlas Scale Cars

50 TON—DOUBLE HOPPER BOTTOM DUMP SCALE CARS

Atlas all steel roller suspension type provided with Atlas Indicating Dial and Tape Recording Apparatus permitting direct reading of separate burden weights. Provides Automatic Registration of weight of load in car by skip pit without repeating.



50 TON DIESEL-ELECTRIC LOCOMOTIVE FOR INTER-PLANT HAULAGE

Atlas Cars for Every Kind of Inter-Plant Haulage

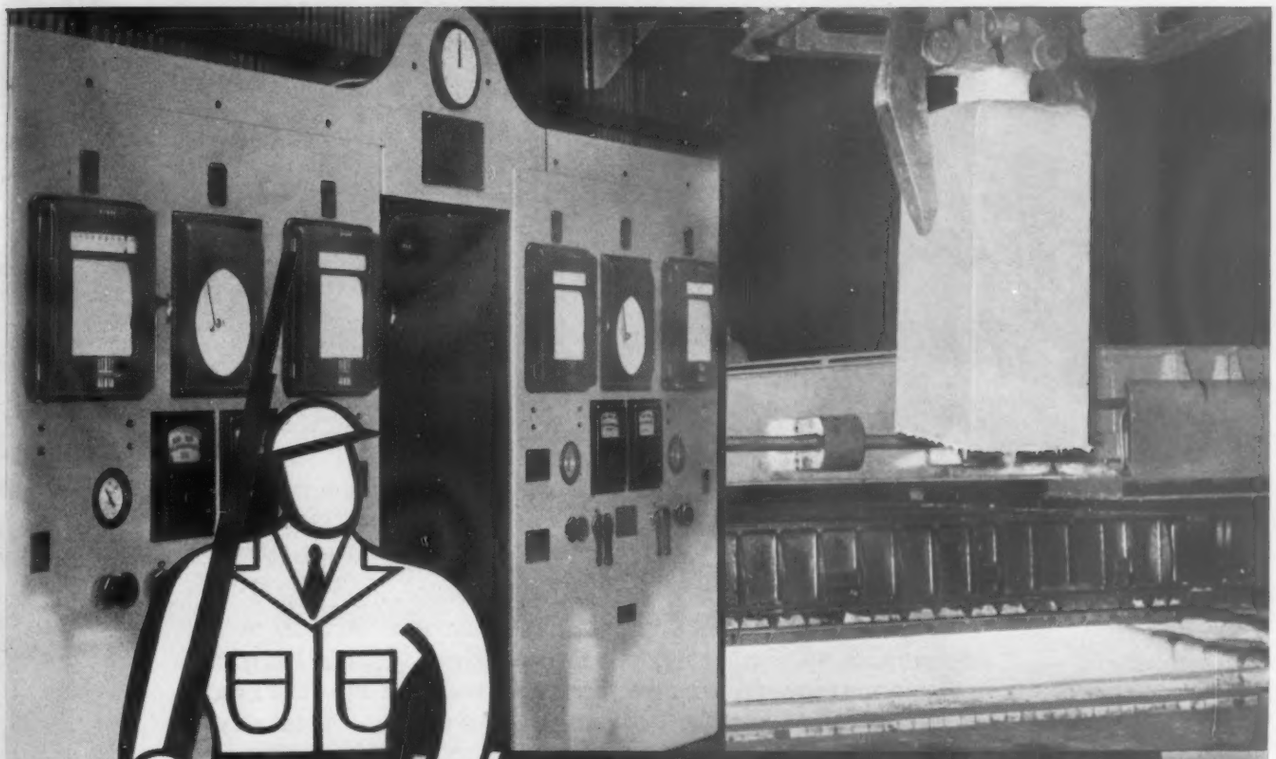
ATLAS PRODUCTS

Electric Locomotives and Cars, Storage Battery Locomotives, Transfer Cars, Scale Charging Cars, Specially Designed Cars for All Purposes, Diesel Electric and Gas-Electric Locomotives, Storage Battery Trucks and Tractors, By-Product Coke and Gas Plant Equipment.

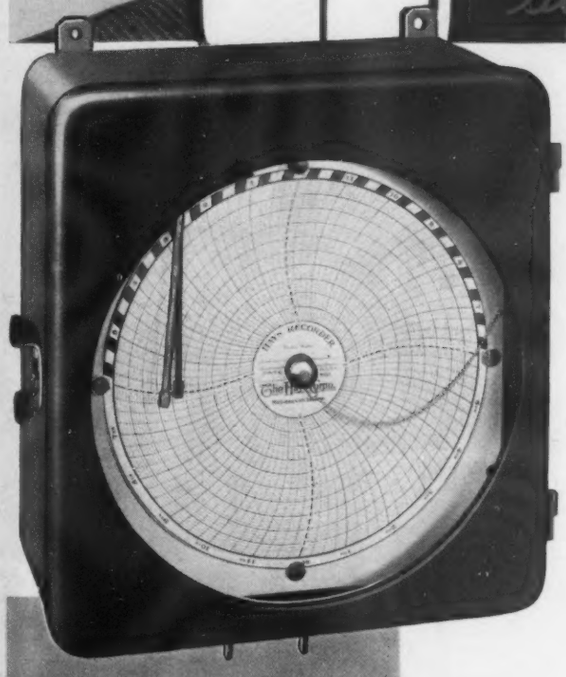
THE ATLAS CAR & MFG. CO.

Engineers *Manufacturers*

CLEVELAND, OHIO



ON GUARD *against guesswork*



GUARDING against production failures is a necessity at any time but particularly so when production schedules are being pushed at top speed. Hays indicating and recording instruments for steel mills accurately indicate combustion conditions in soaking pits, open hearths, annealing furnaces and slab mills—gas pressure indicators, air flow indicators, draft and pressure gages, both indicating and recording, give a constant picture of what's going on inside and guard against harmful, inefficient and costly errors. Write for information.

Address us at 960 Eighth Ave., Michigan City, Ind.

Hays "OT" Draft Recorders show two draft values, two pressure values, two differential values or a combination of any two of these. For SOAKING PITS, OPEN HEARTH, ANNEALING FURNACES, SLAB MILLS. Ask for Pub. 39-232.

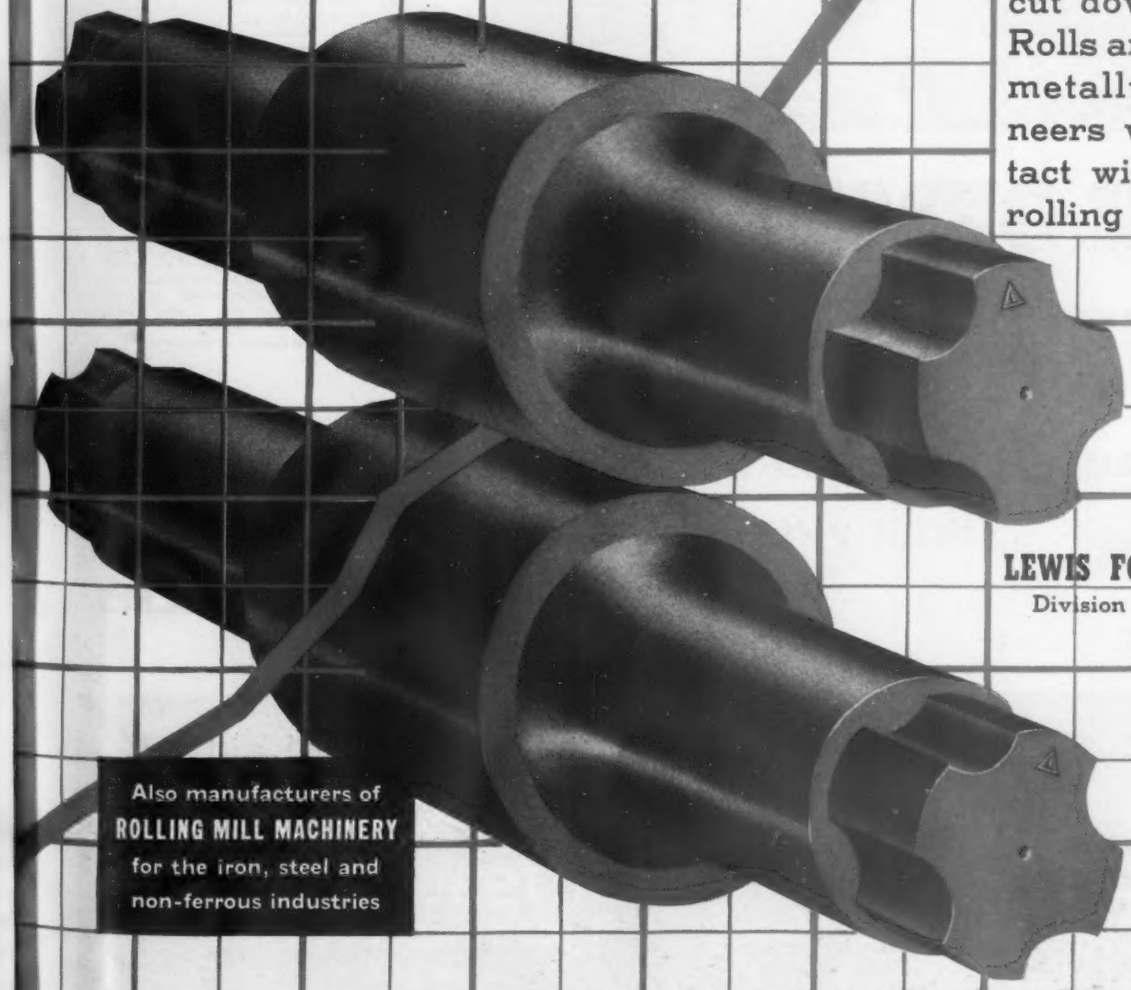
THE HAYS CORPORATION

SINCE 1901 — COMBUSTION INSTRUMENTS AND CONTROL

MICHIGAN CITY, INDIANA, U.S.A.

Flame Hardening...
A routine job for 10 years at NE
. . . Flame hardening of specialized gearing and castings has been routine at National-Erie Corp. for 10 years. You will profit by investigating National-Erie's capacity to meet your specifications for Flame Hardened Steel Castings, under one control from raw material to finished product.
NELOY and NELOY-Molybdenum Steels were developed in the National-Erie Metallurgical Laboratory to be readily adapted for Heat Treating by the Flame Hardening process. Their improved qualities over carbon steel improve the machining performance.
NATIONAL-ERIE
• CORPORATION •
ERIE, NE PA., U.S.A.
MEMBER OF AGMA
MEMBER OF SAE

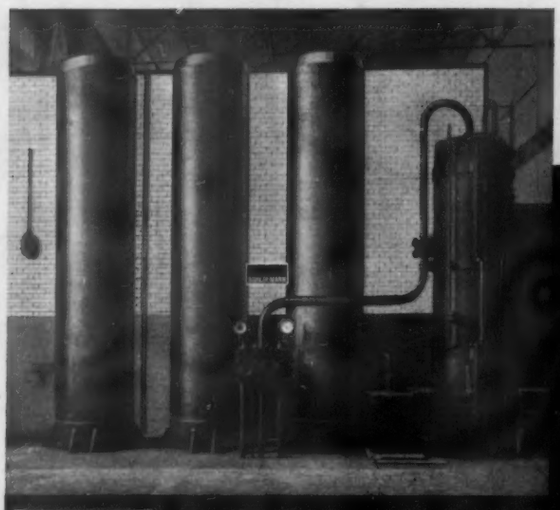
LEWIS ROLLS step up tonnage



There is TONNAGE in LEWIS ROLLS . . . . . and tonnage is economy. Frequency of roll changes is cut down because Lewis Rolls are made by trained metallurgists and engineers with years of contact with steel mills and rolling problems.

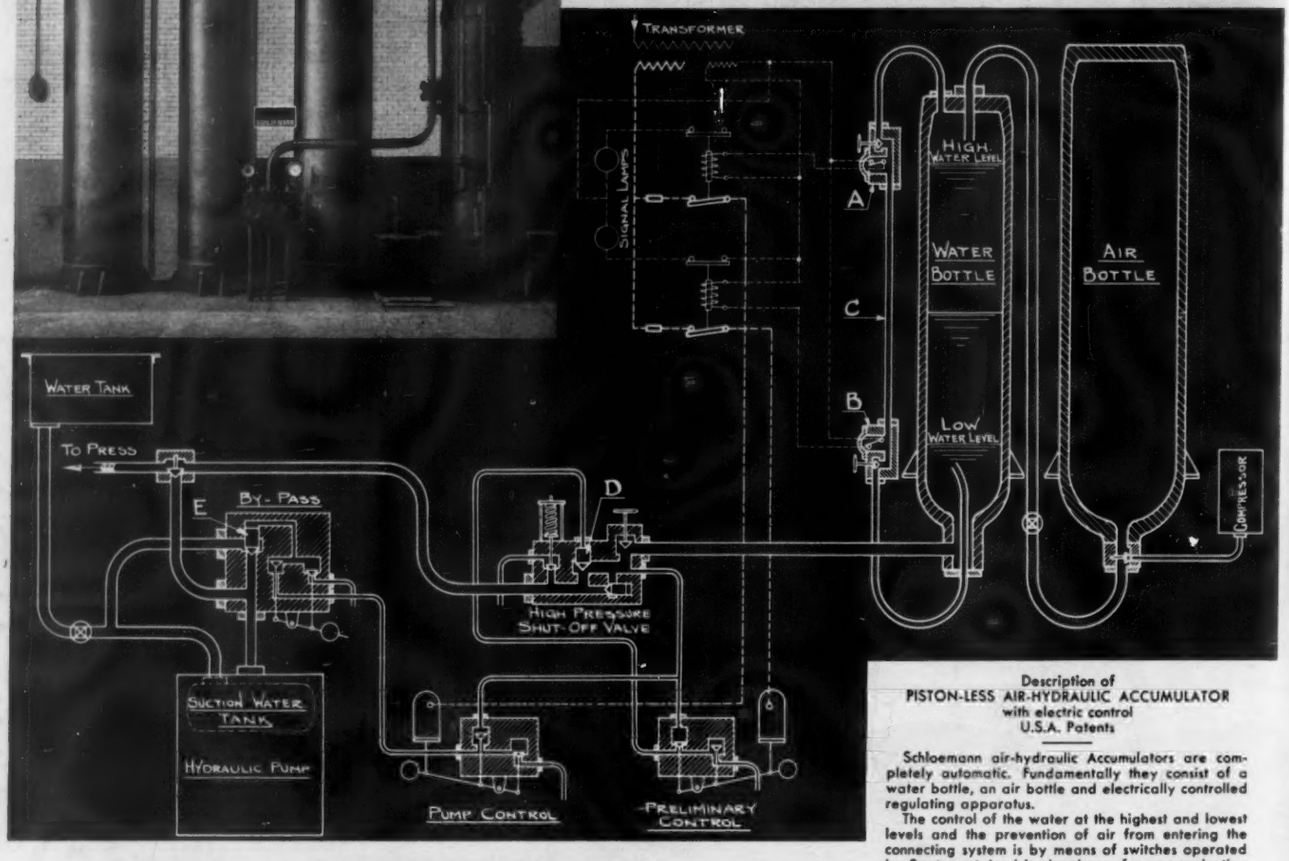
LEWIS FOUNDRY & MACHINE
Division of Blaw-Knox Company
Pittsburgh, Pa.

Also manufacturers of
ROLLING MILL MACHINERY
for the iron, steel and non-ferrous industries



Accumulators furnished in sizes from fifty gallons to twenty-five hundred gallons and for pressures up to forty-five hundred pounds per square inch.

System shown at left has two hundred gallons capacity and is designed for twenty-eight hundred and fifty pounds per square inch pressure.



Description of
PISTON-LESS AIR-HYDRAULIC ACCUMULATOR
with electric control
U.S.A. Patents

Schloemann air-hydraulic Accumulators are completely automatic. Fundamentally they consist of a water bottle, an air bottle and electrically controlled regulating apparatus.

The control of the water at the highest and lowest levels and the prevention of air from entering the connecting system is by means of switches operated by floats contained in chambers of a communicating tube "C." Thus the switch "A" in the upper chamber controls the operation of the hydraulic pump, while that in the lower chamber "B" controls the check valve "D" which shuts off the accumulator at lower water level.

The continuous running pump is controlled by closing the By-Pass check valve "E" by means of the pump control, causing it to idle by opening the same and returning the water to the suction end. Over-pressure is released through safety valves and is indicated by an alarm.

SCHLOEMANN

AIR-HYDRAULIC ACCUMULATORS

HYDRAULIC EXTRUSION PRESSES

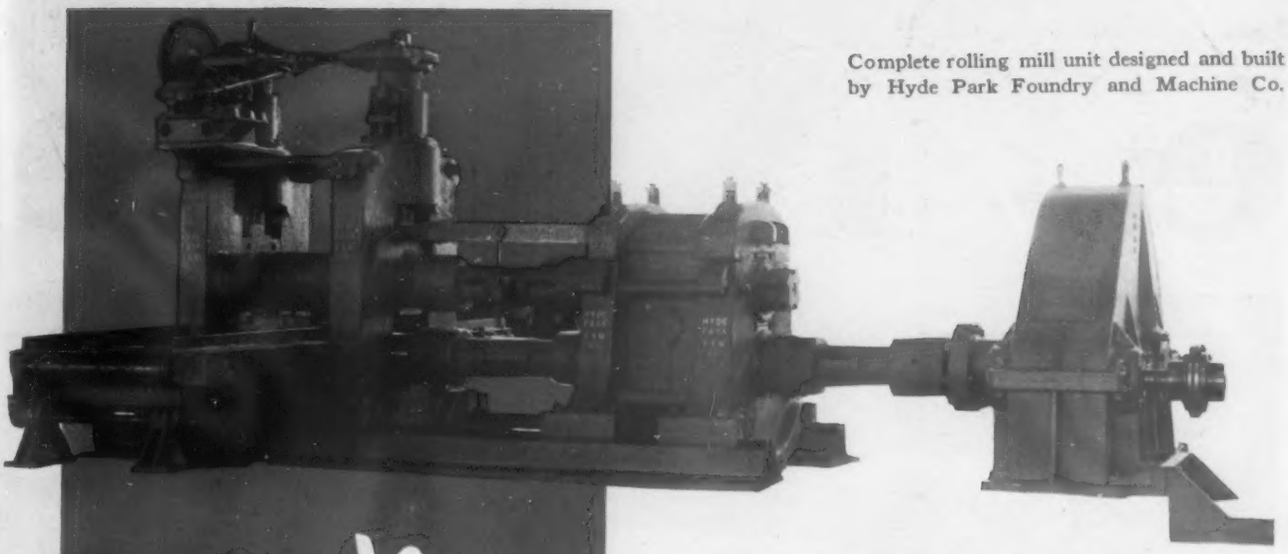
HIGH PRESSURE PUMPS

COMPLETE HYDRAULIC SYSTEMS

SCHLOEMANN

ENGINEERING CORP. Rolling Mill Machinery

PITTSBURGH, PA. Hydraulic Presses



Complete rolling mill unit designed and built by Hyde Park Foundry and Machine Co.

Hyde Park...

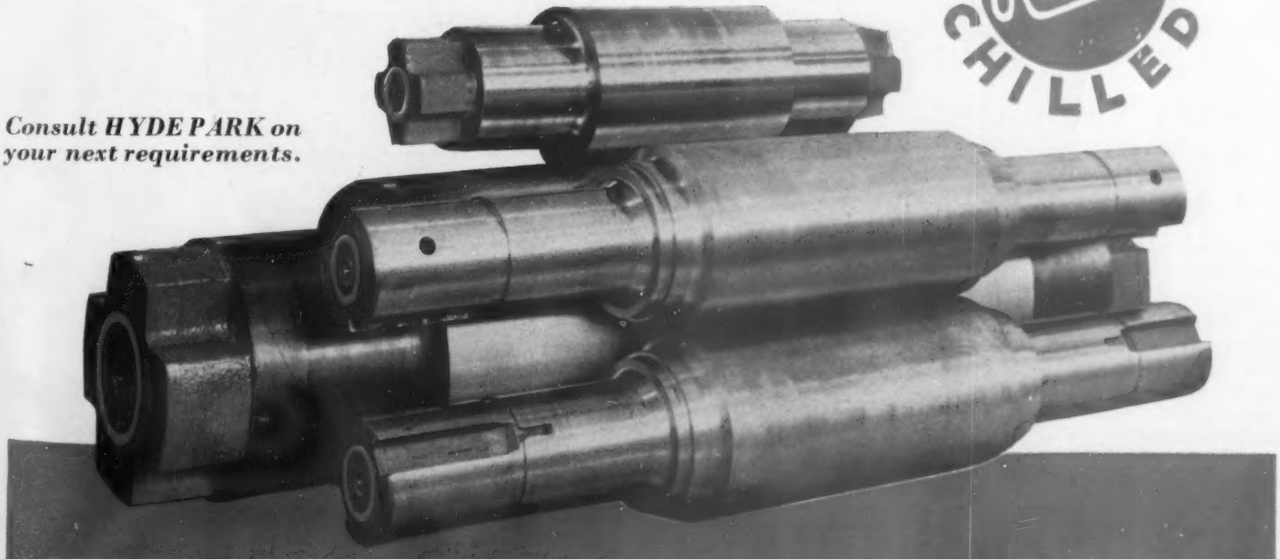
ROLLING MILL MACHINERY and CHILLED ROLLS

HYDE PARK Rolling Mill Machinery includes all kinds of Sheet and Tin Mill Shears, Roll Lathes, Steam Doublers, Sheet Pack Carriers, Stretcher Levellers and Rolling Mill Machinery built to specifications.

HYDE PARK produces the famed "Red Circle" heat treated Alloy and Plain Chilled Rolls for three and four-high Mills, Sheet and Tin Mills, Moly Rolls, Nickel Chilled, Grain Rolls, Cold Rolls and Sand Rolls.

RED CIRCLE Rolls CHILLED

Consult HYDE PARK on your next requirements.



HYDE PARK FOUNDRY AND MACHINE CO.

Hyde Park, Pa. (Pittsburgh District)

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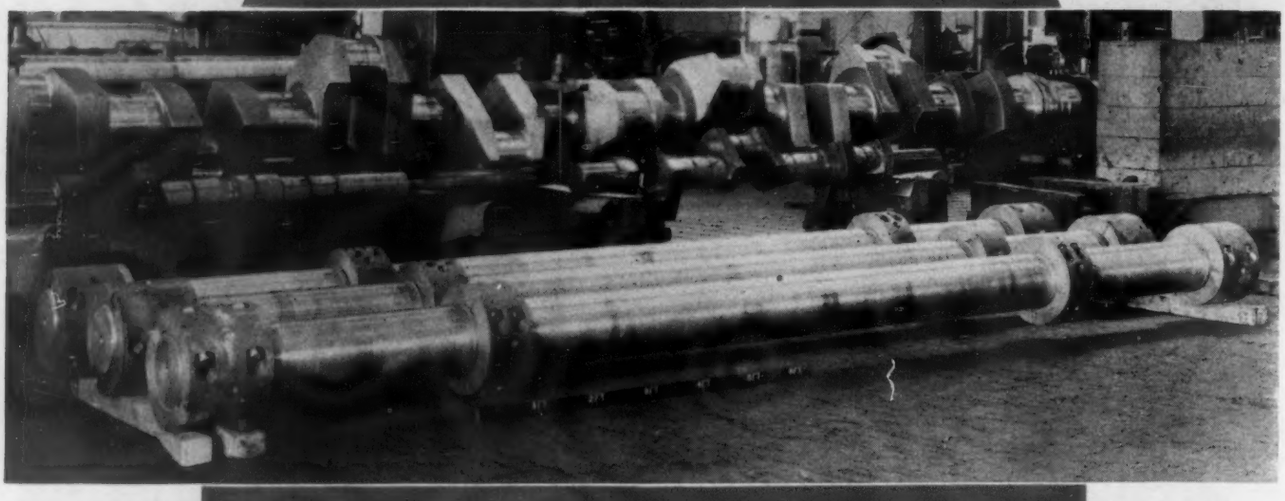


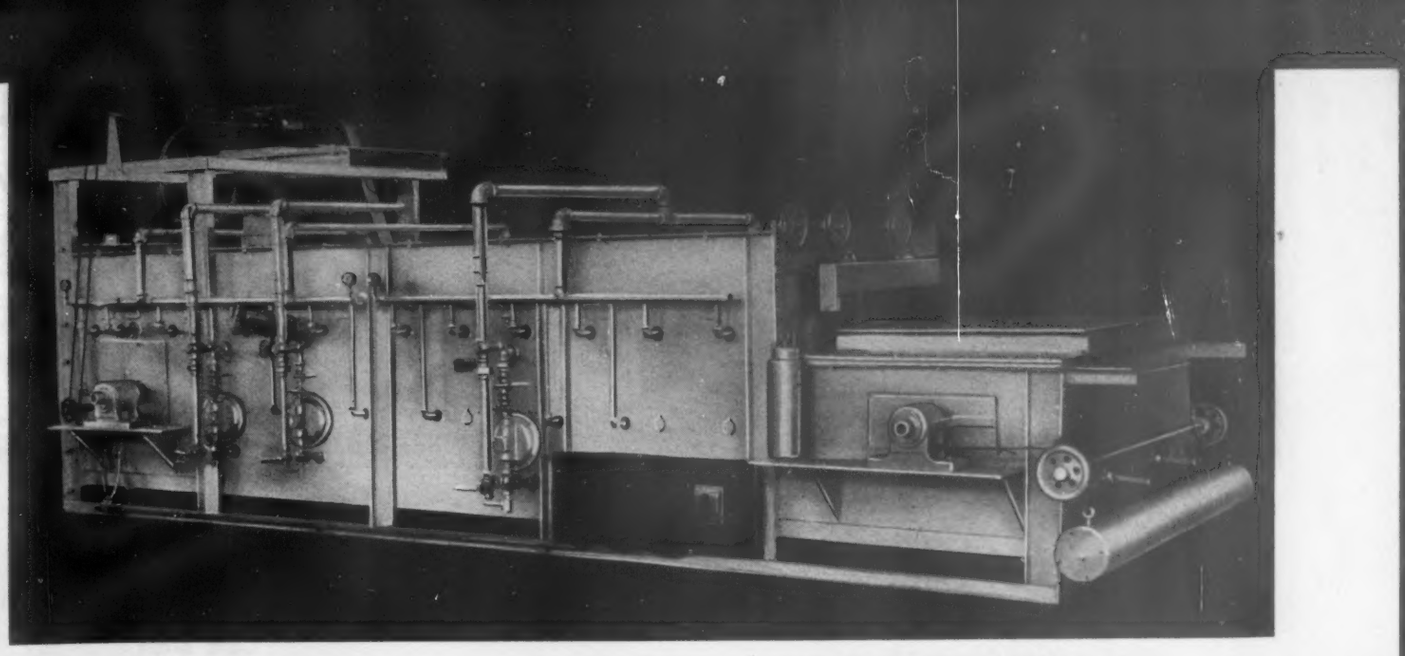
FORGINGS AND STEEL CASTINGS

Illustrated above are several completely finished press columns and Diesel engine crankshafts . . . merely a small portion of the various types and sizes of forgings manufactured at our works. We are proud of the close tolerances to which such parts, applied to many industries, are machined. Leading engine, ship and machinery builders use ERIE equipment consistently because experience has proven that ERIE products have dependability and long life. Concentration on forging and steel casting problems has given us a wealth of experience which you can use profitably. Let us show you why ERIE installations have come to insure satisfactory operation.

INGOTS
BILLETS
CASTINGS
FORGINGS

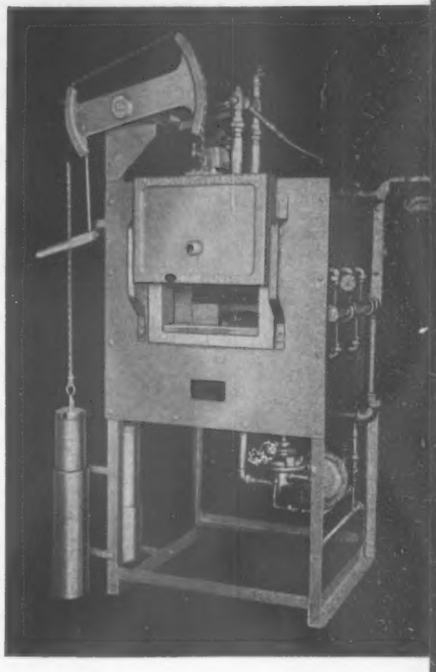
ERIE FORGE CO.

ERIE, PENNSYLVANIA



Above is shown a Link-Belt conveyor Heating Machine used for hardening or normalizing a large variety of forgings. Capacity 600 to 1200 pounds per hour.

To the right is our latest development, a Bell-Oven Furnace for use with specific atmospheres for "Ni-Carbing", carburizing, nitriding, etc.



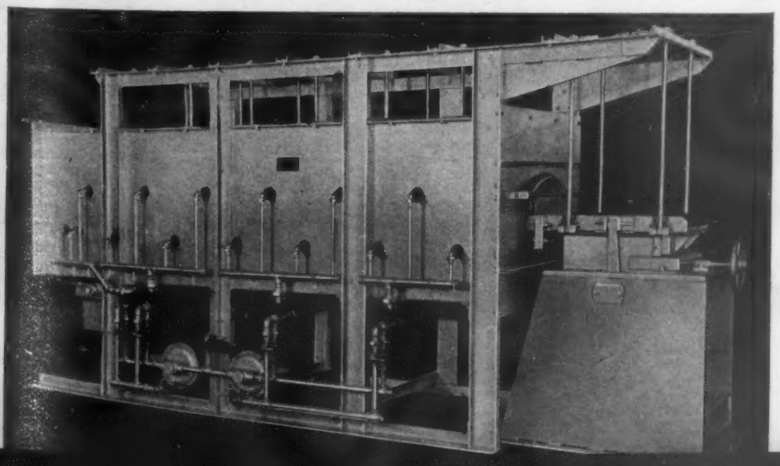
FOR PRODUCTION
TODAY *and* TOMORROW

Today, National Defense is the first consideration of every good American. We are eager to do our part by cooperating with you in filling the heat treating requirements of your National Defense contracts now, and in so doing, to supply you with equipment which can be used to insure profits in NORMAL PEACETIME PRODUCTION thereafter.

AMERICAN GAS FURNACE CO.

ELIZABETH, N. J.

Below, is illustrated the largest of our line of Reciprocating Heating Machines, used to harden rifle clips, machine gun links and a wide variety of small and medium sized work.



Write . . .

FOR YOUR FREE COPY OF OUR NEW CATALOG AND DATA BOOK NO. 602

A special section on S.A.E. steels and their treatment, a hardness conversion table, a temperature conversion table and other data.

It's yours free for the asking. It contains 120 pages of valuable data on all types of heating and heat treating products, including: Blowpipes and Burners, Furnace Burners, Forges, Oven Furnaces, Pot Furnaces, Melters, Heating Machines, Blowers, Tube Furnaces, and many others. This A. G. F. Catalog and Data Book also contains a section on accessories, including: Pyrometers, Automatic Temperature Controls and Flow Meters.

Mail your request today on your company letterhead to be sure of your copy; no obligation.

21 YEARS OF SERVICE
. . . . . EQUIPMENT

BAILEY PRODUCTS

BAILEY THERMAL GOGGLE VALVE
36" to 120" in diameter
Hand or Motor Operated Plate

BAILEY MECHANICAL GOGGLE VALVE
24" to 72" in diameter
Hand or Motor Operated

BAILEY OPEN JOINT CHECKER
For Blast Furnace Hot Blast Stoves

FABRICATED STEEL BOTTOM
For Blast Furnace Hot Blast Stoves

BAILEY ELECTRIC PLUNGER CLAY GUN

BAILEY CINDER NOTCH STOPPER
(Air or Steam Operated)

TROLLEY TYPE CINDER NOTCH STOPPER
(Mechanically Operated)

BAILEY PIG CASTING MACHINE
(Stationary Wheel Type)

AMERICAN PIG RELEASER

BAILEY DOUBLE SHAFT PUG MILL
(Vreeland Method)

BAILEY SINTERING PLANT PUG MILL

PRECISION FEEDER
For Ore, Flue Dust, Sinter, etc.

OPEN HEARTH BURN-OUT VALVE

WATER METERING METHOD
For Wetting Blast Furnace Skip Charge

LADLE SKULLING HOOK

GAS SEAL FOR GAUGE RODS

"SUPERIOR" CHECKER
For Open Hearth and Other Regenerative Furnaces

BLAST FURNACE VALVES

Cold Blast

Chimney Valve

Hot Blast

Mixer & Check Relief

Mixer & Drop Valve

Combined Check & Snort

Positive Mixer Valve

Blow-Off Valve

ALL EQ
GUAR
1920

WILLIAM M. BAILEY

PITTSBURGH

E rnishing BLAST FURNACE
NTTHAT SATISFIES

OUR CUSTOMERS

EUROPEAN AND FAR EAST COUNTRIES

Appleby-Frodingham Iron & Steel Co., Ltd., England.
Barrow-Hematite Steel Co., Ltd., England.
Cargo Fleet Iron Company, Ltd., England.
Consett Iron Company, Ltd., England.
Ford Motor Company, Ltd., England.
Guest, Keen, Baldwins Iron & Steel Co., Ltd., England.
J. Lysaght, Ltd., England.
Shelton Iron & Steel Company, Ltd., England.
South Durham Iron & Steel Company, Ltd., England.
Staveley Coal & Iron Company, Ltd., England.
Stewarts & Lloyds, Ltd., England.
Pease & Partners, Ltd., England.
R. Thomas & Company, Ltd., England.
Colvilles, Ltd., Glasgow, Scotland.
Oesterreichisch-Alpine Montangesellschaft, Vienna, Austria.
Metalloimport, Magnitostroy, U.S.S.R.
Ilva, Genoa, Italy.
South African Iron & Steel Corp., Ltd., South Africa.
Tata Iron & Steel Company, Ltd., India.

UNITED STATES

ALAN WOOD STEEL COMPANY
AMERICAN ROLLING MILL COMPANY
AMERICAN STEEL & WIRE COMPANY
BETHLEHEM STEEL COMPANY
H. A. BRASSERT & COMPANY
CARNEGIE-ILLINOIS STEEL CORPORATION
CHATEAUGAY ORE & IRON COMPANY
PITTSBURGH COKE & IRON COMPANY
FORD MOTOR COMPANY
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GLASS CONTAINERS, INC.
GREAT LAKES STEEL CORPORATION
GULF STATES STEEL COMPANY
HAMILTON COKE & IRON COMPANY
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LATCHFORD-MARBLE GLASS COMPANY
ARTHUR G. McKEE & COMPANY
MINNESOTA STEEL COMPANY
NATIONAL TUBE COMPANY
PITTSBURGH CRUCIBLE STEEL COMPANY
PITTSBURGH STEEL COMPANY
REPUBLIC STEEL CORPORATION
SLOSS-SHEFFIELD STEEL & IRON COMPANY
TENNESSEE COAL, IRON & RAILROAD COMPANY
TOLEDO FURNACE COMPANY
WEIRTON STEEL COMPANY
WHEELING STEEL CORPORATION
WICKWIRE SPENCER STEEL COMPANY
THE YOUNGSTOWN SHEET & TUBE COMPANY

CANADA

HUDSON BAY MINING & SMELTING CO., LTD.
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YCOMPANY . . . *Engineers*

PENNSYLVANIA

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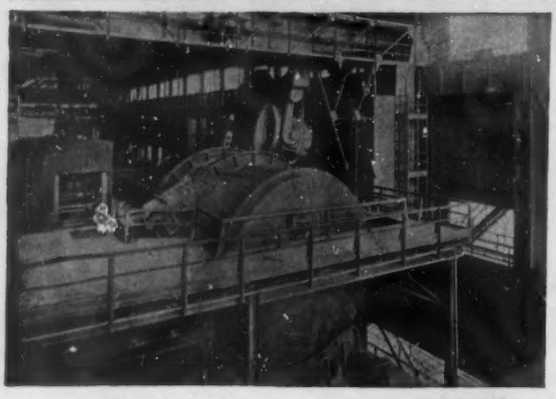
CONVERTERS, MIXERS
TILTING OPEN HEARTH FURNACES
DUPLEX STEEL PLANTS

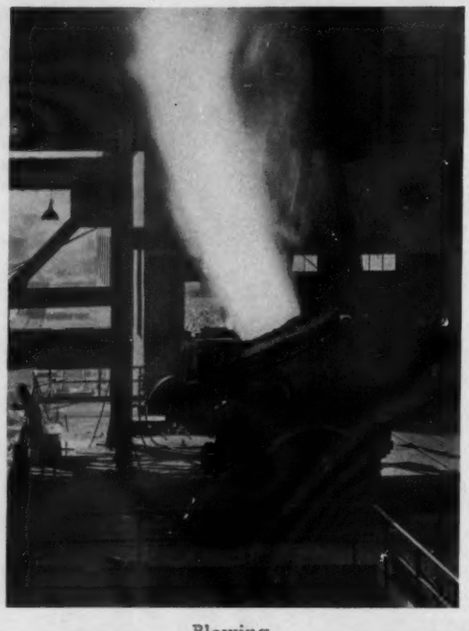


600-ton Mixer

25-ton Converter

THESE pictures give but small evidence of Pennsylvania Engineering Works' contribution to the Steel Industry.

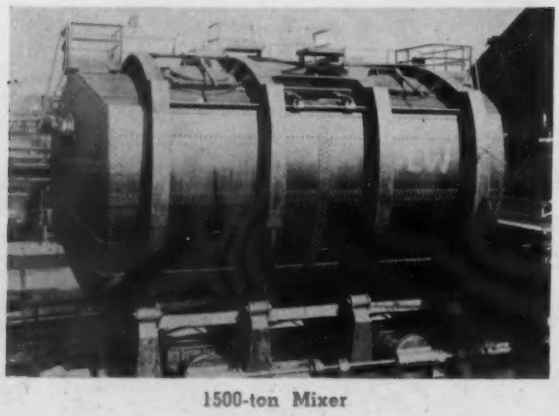
Backed by many years of experience and the great number of installations in the many Steel Plants, the Pennsylvania Engineering Works is prepared to design, fabricate and erect complete Duplex Plants, including Mixers—25 tons to 2000 tons capacity, Open Hearth Furnaces —50 tons to 400 tons capacity— both tilting and stationary, Converters—5 to 50 tons capacity, Converter Jack Cars, Bottom Oven Cars, Regulating Valves, Slag Cars, Ladles, Ladle Cars, Transfer Cars, Jib Cranes and Hauling Systems.



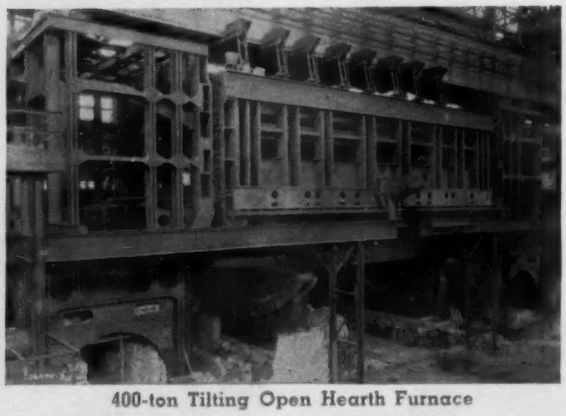
Blowing Charge in 15-ton Converter

Installations of some of the illustrated equipment at

Inland Steel Company
Tennessee Coal, Iron & Railroad Co.
Youngstown Sheet & Tube Company
Illinois Steel Company
Carnegie-Illinois Steel Corporation
Republic Steel Corporation
Bethlehem Steel Company
American Steel & Wire Company
Weirton Steel Company
Jones & Laughlin Steel Corporation
Ford Motor Company, River Rouge
Ford Motor Company, England
Broken Hill Proprietary Co., Australia
Tata Iron & Steel Company, India
Algoma Steel Company, Canada
Steel Company of Canada, Ltd.
Compania Siderurgica del Mediterraneo, Spain
Cia. Fundidora de Fierro y Acero, Mexico



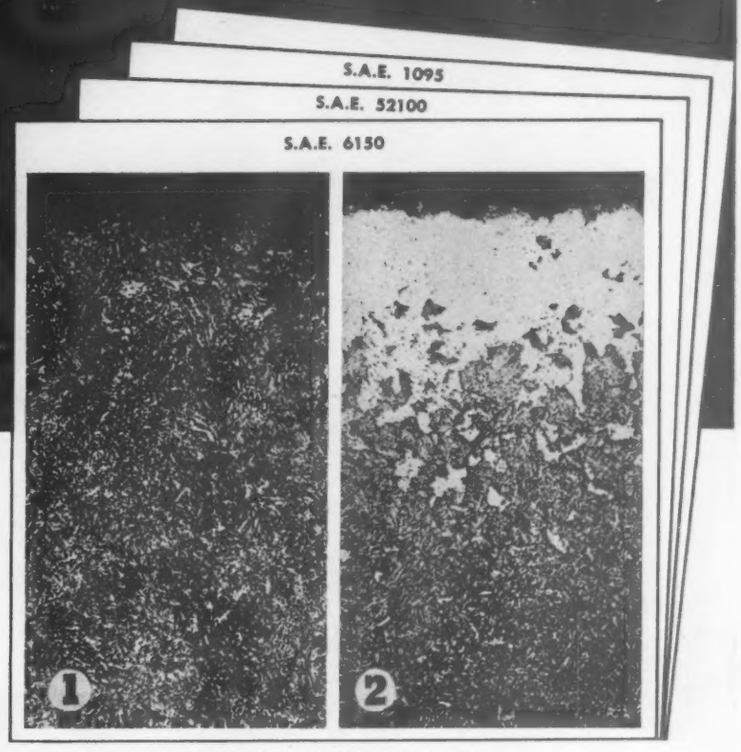
1500-ton Mixer



400-ton Tilting Open Hearth Furnace

Pennsylvania Engineering Works
NEW CASTLE, PENNA.

Photo-micrographs prove...



Magnification 500X—unretouched

ENDOGAS

SCALE-FREE HARDENS ALL S. A. E. STEELS *without* DECARBURIZATION

There's no longer any reason to regard decarburization as a "necessary evil"—even when hardening steels usually considered difficult to treat. Photo-micrographs, such as those shown here, prove that Westinghouse ENDOGAS now makes it possible to treat all S.A.E. steels without "decarb" under production conditions.

Westinghouse ENDOGAS is within the reach of all—is inexpensively obtained by starting from either natural or manufactured city gas. Write today for complete information on this low cost method of bright hardening without decarburization.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

HERE'S THE PROOF FOR SPRING STEEL—S.A.E. 6150

1. ENDOGAS SCALE-FREE HARDENING SHOWS NO DECARBURIZATION...

Micro-section No. 1 proves conclusively that no decarburization takes place when Spring Steel —S.A.E. 6150—is heat treated at 1500° F., for one hour, in Westinghouse ENDOGAS.

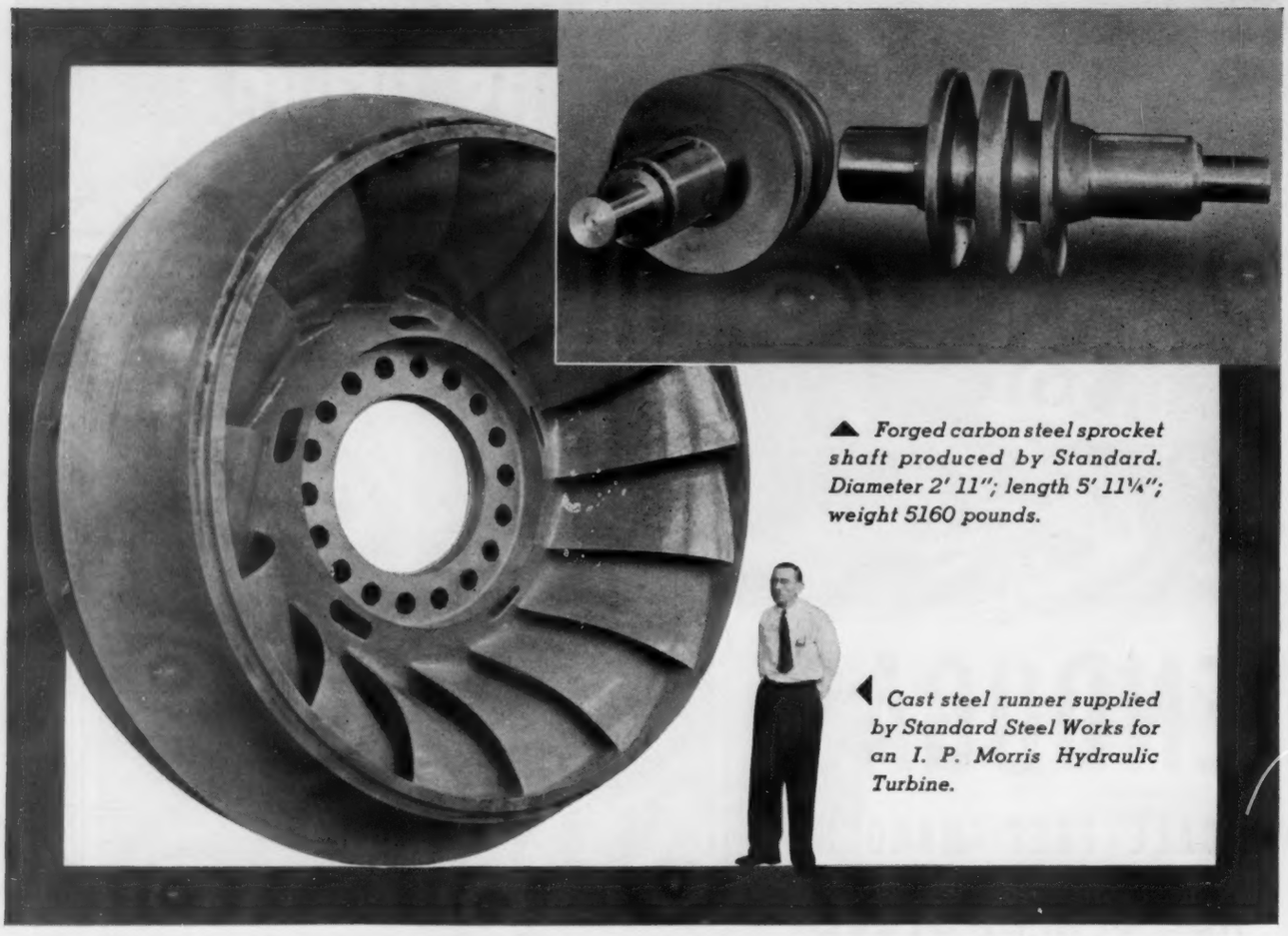
2. ORDINARY SCALE-FREE HARDENING DECARBURIZES TO .005"...

The same steel—S.A.E. 6150—treated in an ordinary scale-free hardening atmosphere at 1500° F., for one hour, is decarburized to a depth of approximately .005", as revealed by the upper white portion of micro-section No. 2.

J-10200

Westinghouse

Complete Heat Treating Equipment



▲ *Forged carbon steel sprocket shaft produced by Standard. Diameter 2′ 11″; length 5′ 11¼″; weight 5160 pounds.*

◀ *Cast steel runner supplied by Standard Steel Works for an I. P. Morris Hydraulic Turbine.*

LET *Standard* HELP

with your Steel Forging and Casting Problems

If your productive capacity calls for a dependable source of supply for steel forgings and castings of unusual design—try Standard.

Good steel, long experience and close control of every step in manufacture, from open-hearth to finished product, assure the satisfactory quality of Standard's forgings and castings.

Won't you discuss your requirements with us and let us advise you how Standard can help?

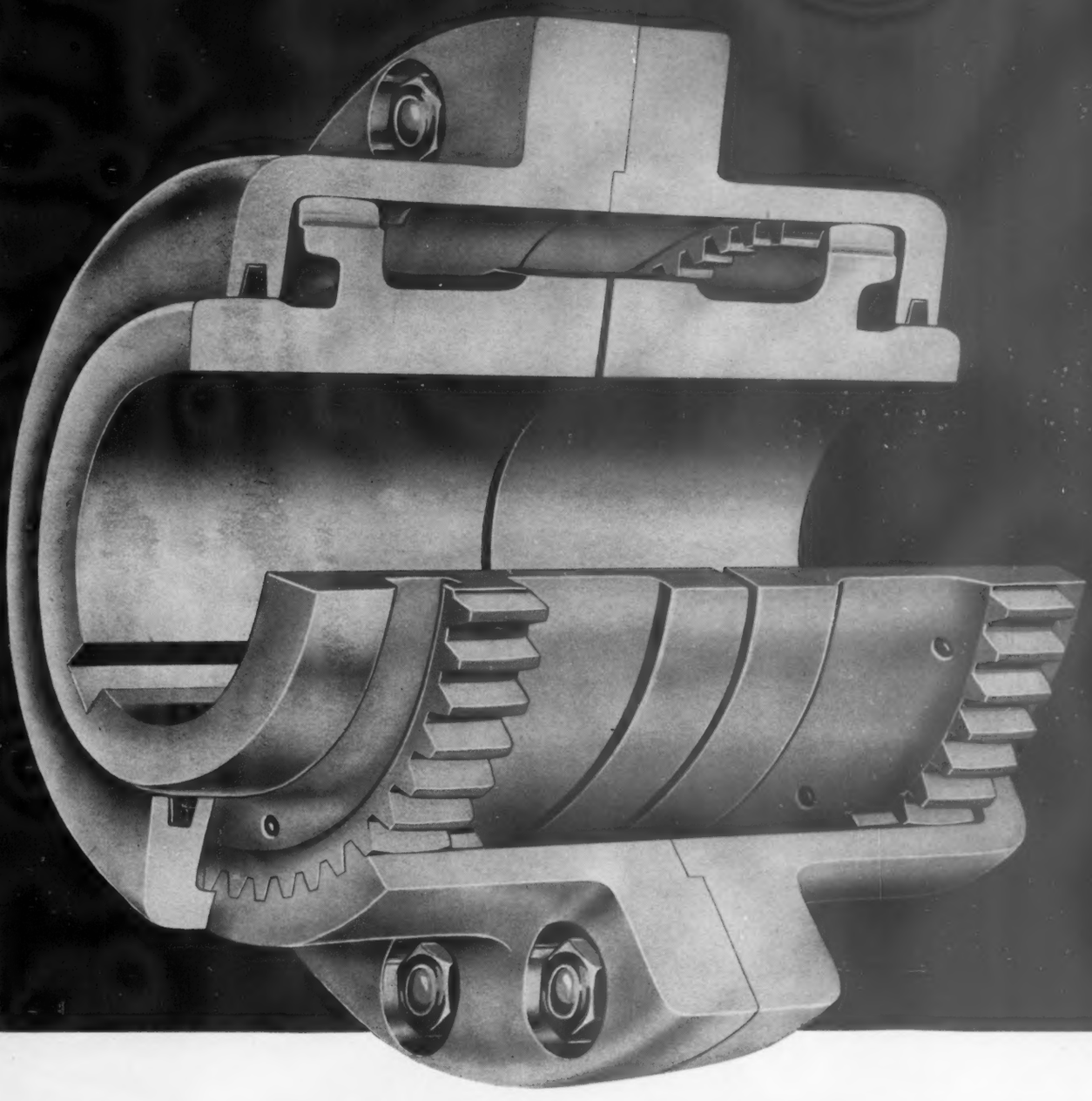
CASTINGS • FORGINGS • WELDLESS RINGS • WROUGHT STEEL WHEELS

STANDARD STEEL WORKS

Division of THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

BLW THE BALDWIN GROUP

POOLE



A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY WOODBERRY, BALTIMORE, MD.

CROMONITE ROLLS BY CONTINENTAL

Custom Built

FOR GREATER TONNAGE
LONGER LIFE

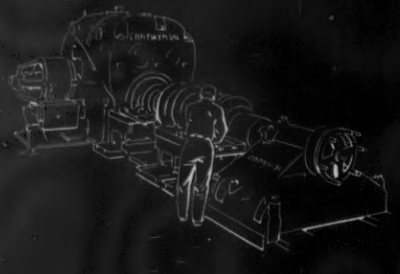
12 years ago, Continental Engineers pioneered a new development which resulted in greater efficiency and smoother operation in the high speed production of strip steel — Cromonite Rolls.

Cromonite leadership in the roll field today is due to the constant research and ceaseless effort on the part of Continental Engineers to bring you a roll that's — Built to roll true, satin smooth, scale tight finishes — Built to last longer — Built to stand up under the most severe high speed operations.

In Cromonite you'll find the best in custom roll craftsmanship.

Investigate Cromonite and the complete line of Continental rolls and rolling mill equipment.

4 PLANTS DUQUESNE DIV., CORAOPOLIS, PA.
HUBBARD DIV., E. CHICAGO, IND., WHEELING DIV., WHEELING, W. VA.



CONTINENTAL

ROLL AND STEEL FOUNDRY COMPANY

CHICAGO **PITTSBURGH**

Just the Ticket

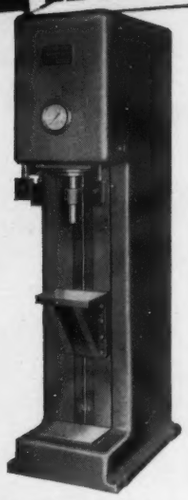
DENISON Small Capacity HYDRAULIC PRESSES

to:- INCREASED EFFICIENCY IN PRESSING OPERATIONS

ACCURATE DEPENDABLE HYDRAULIC CONTROL

SELF-CONTAINED SPACE-SAVING DESIGN

ECONOMICAL OPERATION and MAINTENANCE

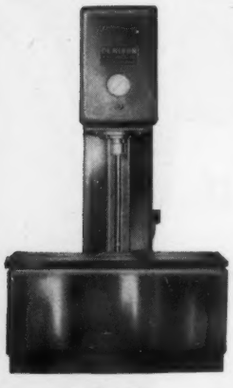


HYDRAULIC ASSEMBLY PRESS

TYPE DLAC2—An ideal press for assembling, straightening, and many other pressing operations. Motor, pump, starter, and pressure and directional controls assembled within the frame. Working capacities from 5 to 50 tons; 24" maximum stroke with 30" maximum vertical opening. Both hand lever and foot pedal controls for ram. Easily modified to individual requirements. (See Bulletin 104.)

HYDRAULIC KNEE TYPE PRESS

TYPE DLKC2—A knee-type hydraulic assembly press designed especially for quick retooling with a variety of bolsters, supports or special tools and fixtures. Exceptionally versatile! In capacities 5 or 15 tons, strokes from 12" to 30"; and arranged for safety and convenient operation. (See Bulletin 105.)



HYDRAULIC STRAIGHTENING PRESS

TYPE DLSC2—A straightening press in 25 and 50 ton capacity. Self-contained frame is modern and space-saving. Note rounded corners and toe space at front for convenience of operator. Will handle bars, flats, tubes, structural shapes, castings and finished parts. Stroke 18"; vertical opening 24". Either hand lever or foot pedal control. An exceptionally economical press to operate and maintain. (See Bulletin 106.)

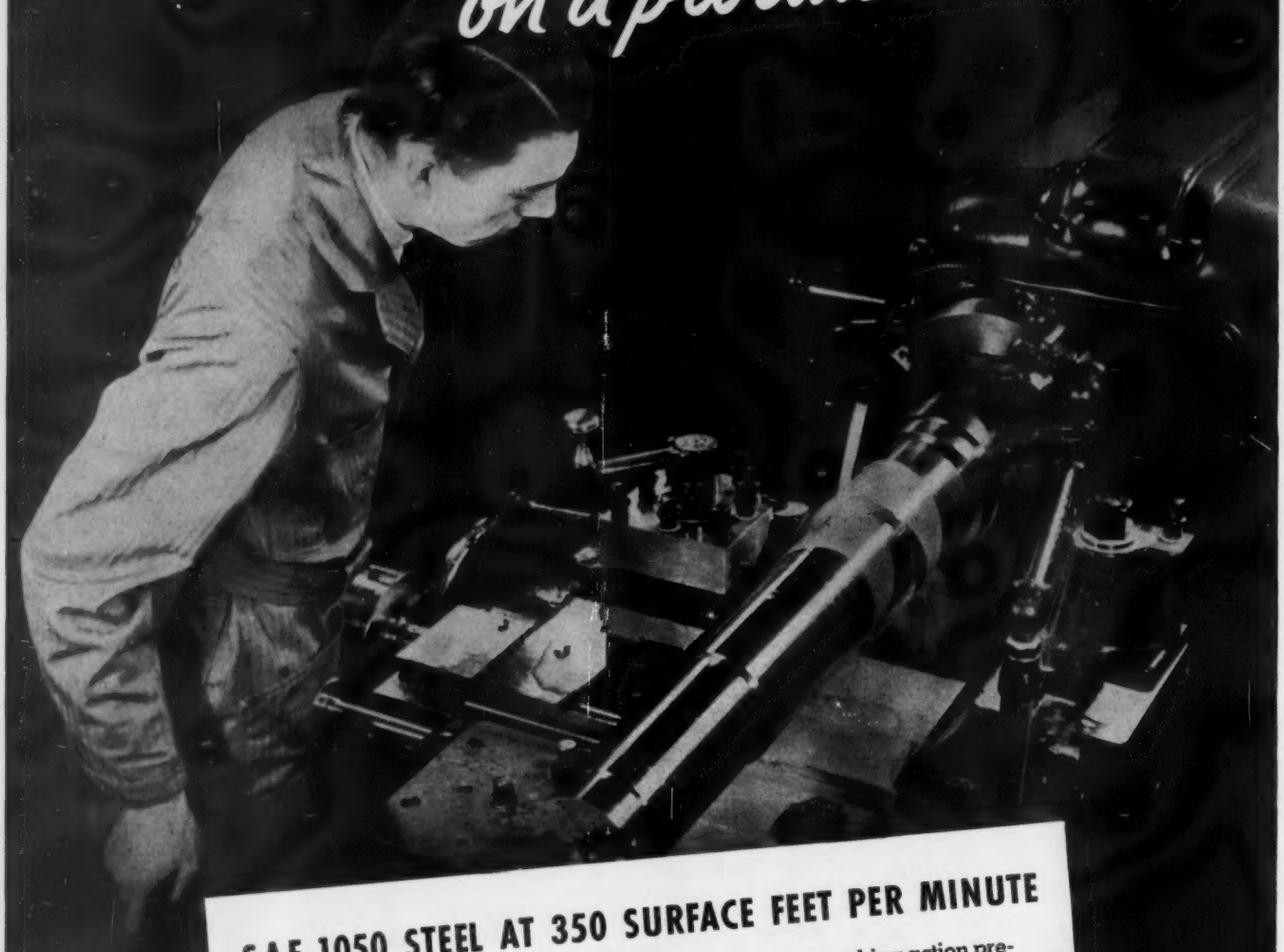
Special Presses and Machinery . . .

Denison also designs and builds all types of special hydraulic presses, to meet individual requirements, many of which are rendering dependable daily service in the foremost plants in the country. With a staff of experienced designing engineers as well as complete manufacturing facilities, they are also regularly called upon by many leading concerns to supply all types of special machinery and production equipment. Such equipment can be designed either entirely by Denison or in collaboration with your Engineering Department. Consult us!

This new line of DENISON Small Capacity HYDRAULIC PRESSES sets a new standard in press efficiency. Their self-contained and space-saving, modern design is indicative of the experience and many engineering improvements that they incorporate . . . features that give you an extra measure of accurate dependability and lasting economy. For safety and appearance all corners and edges have been rounded, and careful attention has been given to the location of hand or foot controls. In capacities from 2 to 100 tons and designed for ready adaptability, they are suited for a wide range of production or small-lot pressing operations . . . straightening, assembling, or other press jobs. Only power connections and oil for the reservoir are required to put these presses into operation. They are money-savers you'll want to add to your lineup. Write for bulletins.

The DENISON ENGINEERING COMPANY
113 W. CHESTNUT STREET COLUMBUS, OHIO

SUNOCO PUTS ACCURACY AND FINE FINISH *on a production basis*



Removing 35 cu. inches of metal a minute on an 18" x 54" American Pacemaker Multi-Production Lathe.

SAE 1050 STEEL AT 350 SURFACE FEET PER MINUTE

When this is the order for production there must be the closest coordination between machine... metal... tools... cutting lubricant ... and above all the mechanic.

That's why skilled mechanics throughout the metal working industry choose SUNOCO Emulsifying Cutting Oil, when it is necessary to take heavy cuts at high peripheral speeds with cemented carbide tools. They know the high heat absorbing and lubricating properties of Sunoco keep the work and tools cool... its washing action prevents chips from clogging... and produce more accurate work in less time.

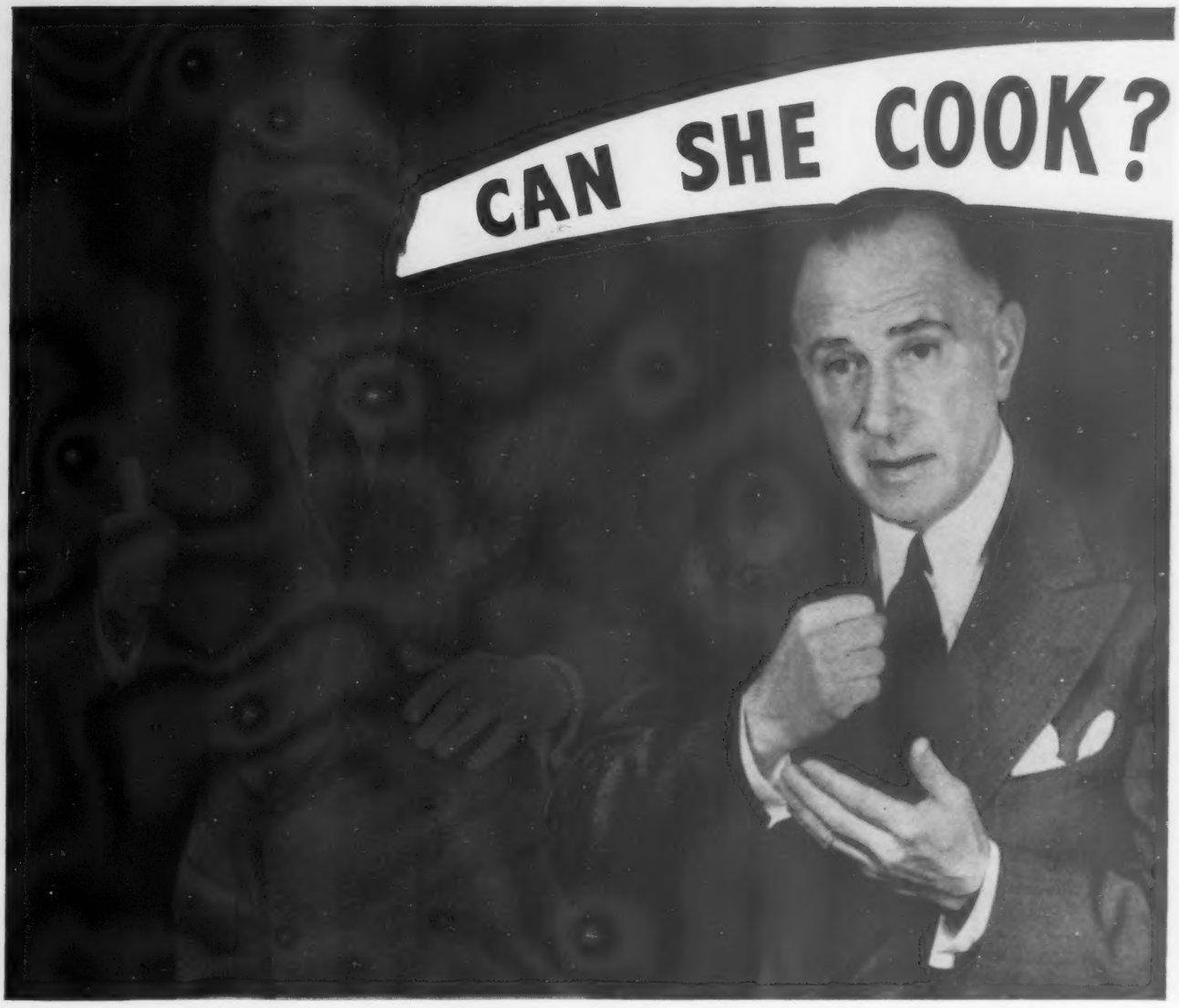
Next time the production order looks tough take a tip from the leading machine tool builders. They know to save production time... tools and material... it pays to specify

SUNOCO
EMULSIFYING
CUTTING OIL

Photograph Courtesy of American Tool Works Co.

SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES



ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

ALTER EGO: So you're aiming to let smooth appearance, alone, sway your judgment of a weld?

But you'll have to admit this new rod gives a good-looking weld.

ALTER EGO: Since when has physiognomy become the lone true measure of character? The effect of swell appearance, whether animal, vegetable or mineral, is only to set up conjecture.

Like the old story which ends "Yes—but can she cook?"

ALTER EGO: Precisely! Let's strive first for sound, substantial values in the welds we make. Then when we get those rich qualities, plus the glamour of smooth appearance, we've got something!

Don't we have that in "Fleetweld?"

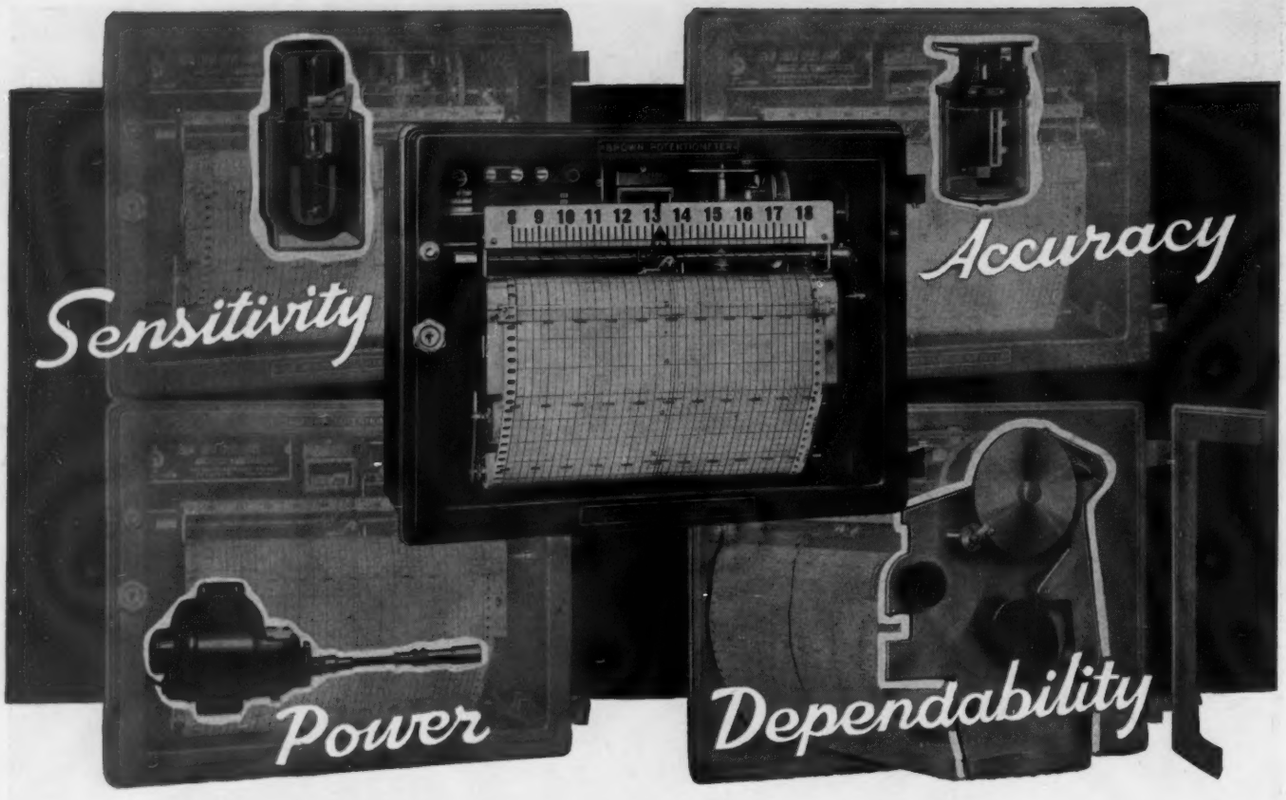
ALTER EGO: Sure we have! Want to double-check?

• •

LINCOLN SUGGESTS: How can *you* (and your "Alter Ego") verify your hunches that "Fleetweld" costs less per pound deposited . . . that it's *faster* and gives *stronger, smoother* welds? On Page 5 of the new "Weldirectory" (gratis) you'll find a 30-Point Check Chart to guide you in making a thorough investigation of electrodes. A post card request will bring it promptly.

Copyright 1941, The Lincoln Electric Co.

LINCOLN "SHIELD-ARC" WELDING
THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio
Largest Manufacturers of Arc Welding Equipment in the World



UNIT CONSTRUCTION *Permits*

QUICK DELIVERY

Brown Potentiometer Pyrometers are rugged, precision-built instruments and guaranteed to give the performance required for industrial service today or tomorrow.

Like a fine automobile, the working parts of these instruments are assembled into major units.

Because of our expanded facilities and modern manufacturing methods, an ample supply of Brown Potentiometer Pyrometer Units is now in stock—ready to be calibrated and assembled to meet your specific requirements.

The mighty industrial defense program is geared to run at a tremendous pace. SPEED UP! SPEED UP! is today's demand in the Metal Working Industry.

It is our desire to assist you in every way possible to speed up production. Write, phone or wire our nearest branch. Tell us your need . . . We'll follow through if you need charts, ink, marking ribbons, thermocouples, protecting tubes, and extension lead wire . . . in fact, every standard item you need can be shipped immediately.

Leading metallurgists who demand prompt delivery, extreme precision and reliable measurement and temperature control of all types of electric, gas, or oil-heated units specify Brown Potentiometer Pyrometers to improve quality, reduce costs.

THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4462 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street—Amsterdam-C, Holland: Wijdesteeg 4—England: Wadsworth Road, Perivale, Middlesex—Stockholm, Sweden: Nybrokajen 7.

RAPID REPAIR SERVICE

If an accident damages a Brown Potentiometer Pyrometer, it can be returned to service promptly. A Brown factory-trained service engineer will bring new parts and make repairs in your plant.

Get the facts about Brown Periodic Service. Discover how little it costs you to have your instrument investment protected by a nationwide organization of factory-trained service engineers who already supply Brown Periodic Service to more than 2,000 industrial plants.

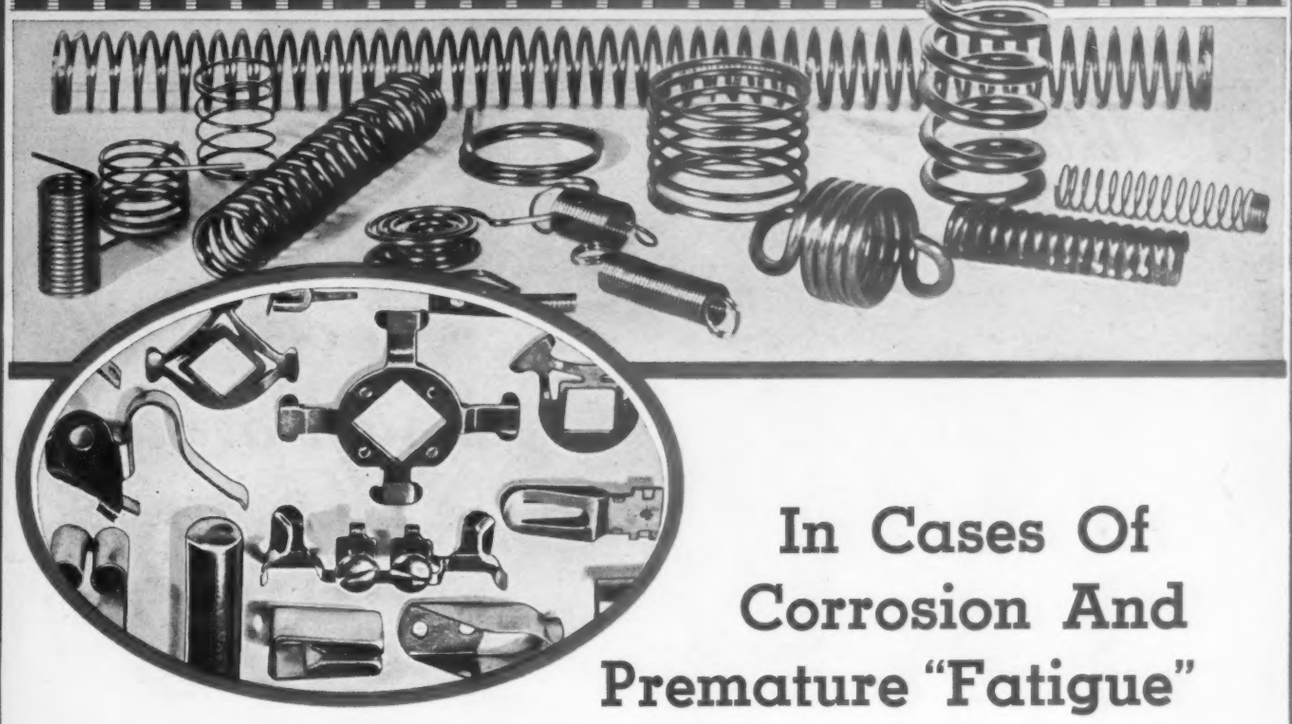
BROWN POTENTIOMETER PYROMETERS

AND

MINNEAPOLIS · HONEYWELL CONTROL SYSTEMS

To Measure and Control is to Economize

SEYMOUR *Phosphor Bronze*



In Cases Of Corrosion And Premature "Fatigue"

Often the Only Answer!

CORROSION is an outlaw who respects nobody's property!

Unless firmly resisted he will sabotage every vulnerable part of your product. Knowing this, far-sighted designers and production engineers thwart the ravages of corrosion by making such items as springs, slides, nuts, cams, trimmings, etc., of Seymour Phosphor Bronze.

Seymour Phosphor Bronze, an alloy of copper, tin and phosphorous, has extremely high resistance to corrosion. This property alone justifies its use in any product containing vital metal parts which must give smooth, uninterrupted service in fresh or salt water dampness—but it has many another advantage.

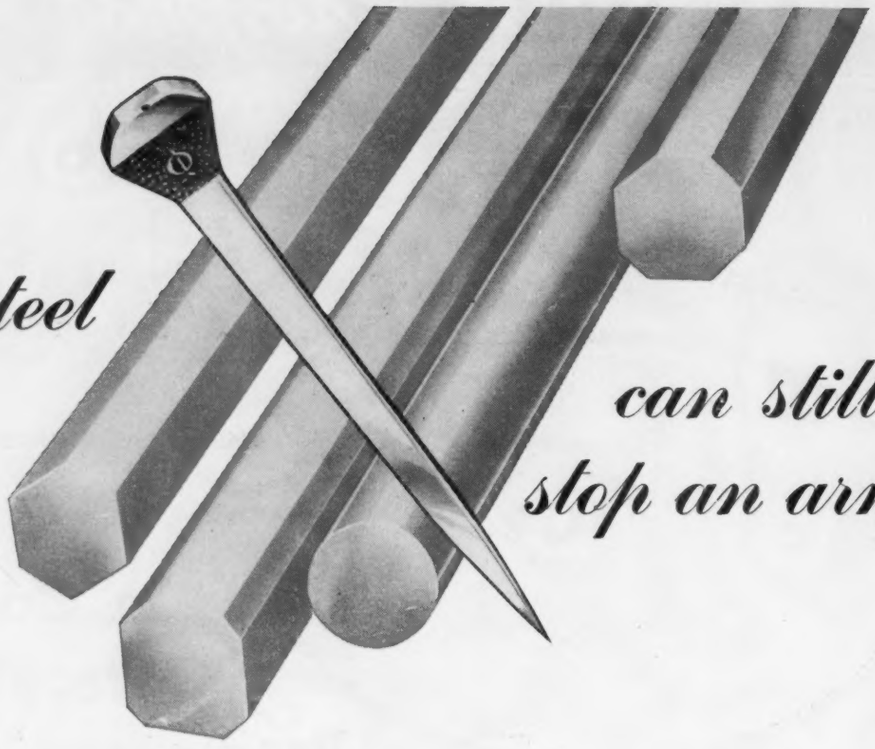
It is very tough and takes a spring temper that will withstand thousands of "fatigue" cycles without impairment of working resilience. It is practically indifferent to sudden thermal change, offers no fire risk from sparks when struck, and, when electrically charged, develops little, if any, "arc."

Supplied in wire in practically all gauges—round, flat, square or fancy—also in sheets and coils for stamping. Samples for test purposes and catalog sent on request.

THE SEYMOUR MANUFACTURING COMPANY
51 Franklin St., Seymour, Conn.

ALSO: NICKEL SILVER AND NICKEL ANODES

A little piece of steel can still stop an army



For want of a nail the shoe was lost;
For want of a shoe the horse was lost;
For want of a horse the rider was lost;
For want of the rider the battle was lost;
All for the want of a horseshoe nail.

WHEN the dispatch rider of the old proverb came to grief, armies were men and horses, equipped with weapons. But the want of a little piece of steel can still seriously handicap a modern army, which is largely machines directed by soldiers.

If delay occurs in tooling up, the entire production schedule is thrown out of gear. Time lost is hard to make up, and late delivery of necessary units of defense equipment may well be traced to the want of a little piece of tool steel.

A. Milne & Co. are keenly aware of the importance of getting you the steel you want, *when you want it.* Many grades can be delivered immediately from our well-stocked warehouses. When a steel is not directly available, *you can rely on Milne's delivery promise.*

Let Milne's long experience help you avoid becoming a "bottle-neck." For tool steels, or special-purpose alloy steels, write or phone A. Milne & Company, 741 Washington Street, New York, or the branch office nearest you.

ARISTOLOY
ALLOY STEELS

Electric Furnace and Aircraft qualities, for mill shipment and for shipment from warehouse stock.

KOLORKOTE
TOOL STEEL

High Speed Steels — High Alloy Steels
Carbon Tool Steels — Graphitic Steels

Bars color-coated to distinguish grades
Heat treating instructions with every shipment

MINING DRILL STEEL
Hollow — Solid — Auger

LA SALLE
STRESSPROOF STEELS

A true engineering steel especially suited for maintenance and repair, and high strength members for machine tools and parts.

This high strength steel frequently replaces heat treated alloy steels.

For mill and warehouse shipment
Sizes 3/8" to 3 1/4" round

A. MILNE & CO.

STEEL MERCHANTS SINCE 1887

PHILADELPHIA Bourse Bldg. — PITTSBURGH 604 Frick Bldg. — BOSTON 109 Broad St. — NEW YORK 741 Washington St. — CHICAGO 17 N. May St. — HOUSTON P. O. Box 9076 — DULUTH 1834 Vermilion Road

HELP
from MAGNETIC HEADQUARTERS
WHICH OF THESE JOBS DO YOU WANT DONE?
SCREW DOWN ON MILL STANDS?—Dings High Intensity Magnetic Clutches.
REMOVAL OF IRON FROM FOUNDRY SAND, SLAG OR REFUSE?—Dings Magnetic Pulley and Magnetic Drums.
SEPARATION OF FERROUS AND NON-FERROUS CUTTINGS, ETC? The Dings XM Drum Type Separator. Also a model with agitating tray for mechanically entangled particles.
CONVEYING OF PIPE OUT OF SPELTER? Dings concave magnetic pipe rolls. Also magnetic table rolls.
HANDLING OF SCRAP, SLABS, COILS, etc? Dings High Intensity Lifting Magnets.
REMOVAL OF MAGNETIC METAL FROM CUTTING OIL? Dings Type U or Type T separators.
REMOVAL OF MAGNETIC METAL FROM CIRCULATING LUBRICATING OIL? Dings De-Ironer.
DESTRUCTION OF RESIDUAL MAGNETISM IN METAL HANDLED BY LIFTING MAGNETS? Dings De-Magnetizer.
These and many other jobs are being done in hundreds of plants by Dings, the world's largest exclusive builder of electro-magnetic equipment. You'll save time and money by letting Dings do these jobs in your plant. Write to Magnetic Headquarters for literature today.
DINGS MAGNETIC SEPARATOR CO.
663 Smith St. Milwaukee, Wis.
Dings
MAGNETIC SEPARATION
HIGH INTENSITY

The answer to switching & haulage service demands

It isn't very often that steel mills operate at peak capacity; the golden days are fleeting, and management is on its toes during every rushing day, looking for ways to speed production, methods of trimming costs, means to improve service. Switching and haulage service comes in for its share of attention—and this is where WHITCOMB LOCOMOTIVES come in. In mills and industrial plants all over the country, WHITCOMB Diesel locomotives, similar to the model pictured here, are doing yeoman service. Their chief qualifications for the job are these: they stand up under long hours of continuous service, they withstand terrific abuse and punishment, and they perform with the barest attention to maintenance. These uncomplicated and inexpensively produced locomotives are acclaimed by users as the practical solution to demands for better service, for dependable service, for cheaper service. There is a WHITCOMB locomotive for your service: ask to see it operate, or send for a copy of our latest book on WHITCOMB industrial type Diesel locomotives.

The Whitcomb Locomotive Co.

BLW THE BALDWIN GROUP

Subsidiary of the Baldwin Locomotive Works

PLANT AT ROCHELLE, ILL.

"CMP ACCURACY HELPED ME TO A BIGGER BONUS!"

THE TEST THAT TELLS

CMP strip is available in regular carbon and spring steel analyses and tempers. Large stocks in various sizes and finishes are ready for quick shipment. If you are interested in increasing fabrication economy and product quality, request test samples now.

"AND THAT'S NOT ALL EITHER"—

"Today's stepped-up production must not falter—our fabrication pace depends largely upon the supply of uniform cold rolled strip steel. It's vital to our profits, too, for when steel retards production speed, runs high in rejects and lacks salable appearance, the final product cost is out-of-line—that doesn't boost a bonus. CMP strip was our answer. We can count on CMP holding to specifications—each coil in every shipment as near alike as possible. Their system of direct mill cooperation minimizes our strip problems."

Perhaps you, too, can reap benefits from the CMP precision facilities like so many fabricators are doing today. We invite your investigation. Write, wire, or better yet, phone Youngstown 4-3184 for immediate action.

CMP STRIP STEEL

PRECISION COLD ROLLED

THE COLD METAL PROCESS CO. YOUNGSTOWN, OHIO

..Dependable!

Miners and Shippers of
Lake Superior Iron Ores

• • •

Vessel Transportation
on the Great Lakes

• • •

Coal for Industrial and
Domestic Use

THE CLEVELAND-CLIFFS IRON CO.

UNION COMMERCE BLDG. - CLEVELAND, OHIO

Popular Springs that make Good Mixers

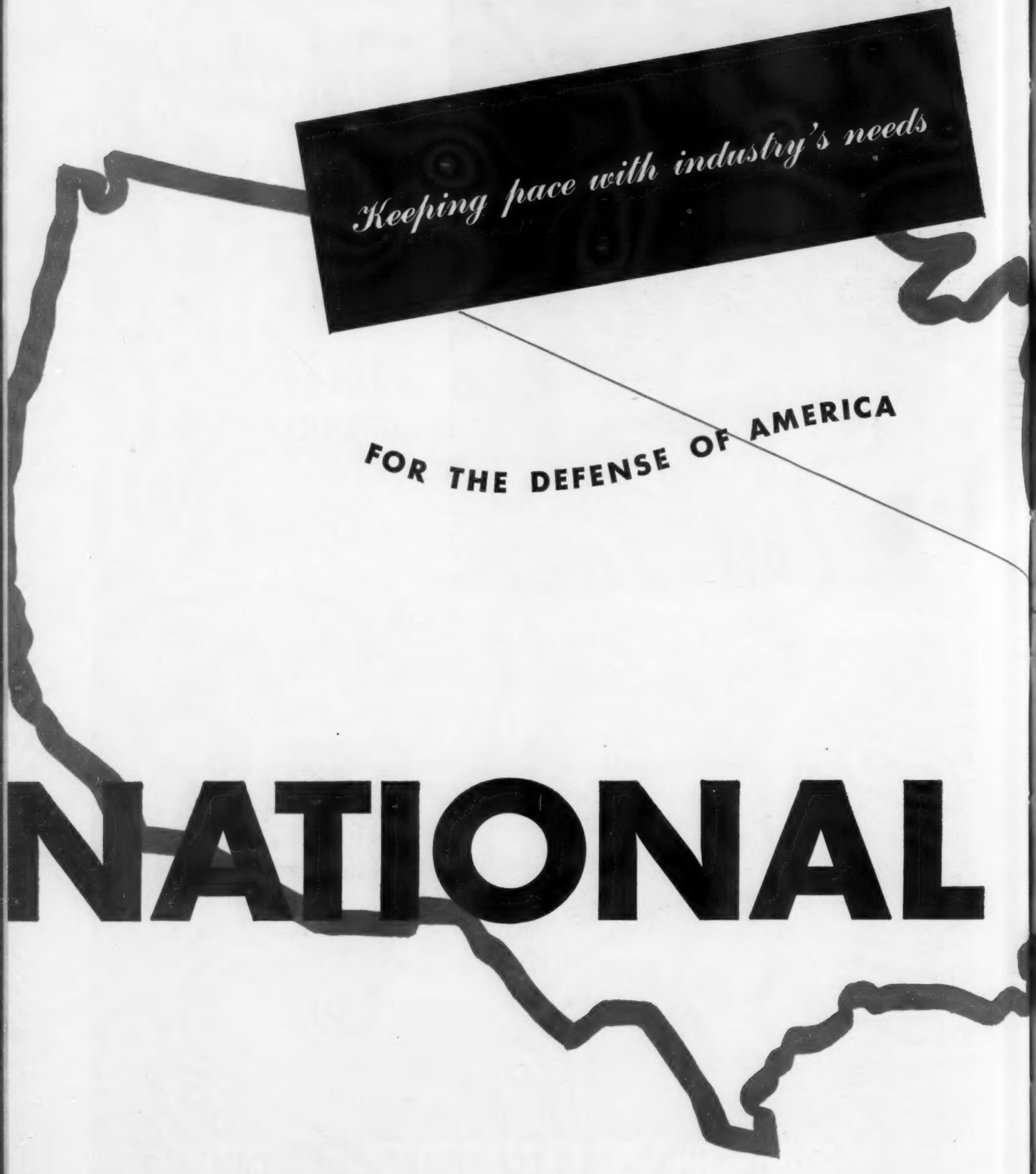
NO need tellin' how to improve a "tall one" with the invigorating qualities of White Rock—from famed mineral springs of Waukesha . . . therefore, let's divert our energy into tellin' how to better the spring mechanization of your present or about to be introduced product.

Just as White Rock teaches us that all mineral springs are not alike, so does LEE confirm a like theory on mechanical springs. Aside from a spring's design, which is *ultimately* important, the quality and proper analyses of the metals involved; the precautions and care exercised in their forming, and the final tempering are all vitals commensurate to a superior product.

Write for your copy of "WHAT YOU DON'T KNOW *CAN* HURT," together with our revised *specification form* to assist you in designing and specifying springs... They're both free, and like White Rock—may prevent your product from going *"flat."*

LEE SPRING COMPANY, INC.
30 MAIN STREET BROOKLYN, N. Y.

LEE-BUILT TRADE MARK SPRINGS


Keeping pace with industry's needs
FOR THE DEFENSE OF AMERICA
NATIONAL

STEEL

Weirton Steel Company

Pig Iron . . . Open Hearth Steel . . . Billets-Slabs . . . Sheet and Tin Bars . . . Steel Plates—Tie Plates . . . Angles, Bulb Angles, I Beams, H Beams, Wide Flange Beams, Channels (Standard, Car and Ship Building), Car Center Sills, Tees (Rolled and Slit), Zees, Sheet Piling . . . Hot Rolled Strip Steel . . . Cold Rolled Strip Steel . . . Hot Rolled Sheets . . . Cold Rolled Sheets . . . Long Terne Sheets . . . Galvanized Sheets . . . Galvanized Formed Roofing . . . Cold reduced WEIRITE Coke Tin Plate . . . Special Coated Manufacturing Ternes . . . Copper Bearing Roofing Terne Plate . . . Tin Mill Black Plate . . . Lacquered Tin and Black Plate . . . Angle Bars—Rail—Spikes . . . Bars—Rounds—Squares.

Great Lakes Steel Corporation

Hot Rolled Strip (down to 1 inch wide) . . . Hot Rolled Strip Sheets (up to 91 inches wide) . . . Spring Steel (carbon and alloy) . . . Merchant Bars . . . Forging Bars . . . Automobile Bumper Sections . . . Bar Mill Sections . . . N-A-X HIGH TENSILE Bars, Shapes, Sheets, Billets . . . Sheet Bars . . . Hot and Cold Rolled Sheets . . . Michigan Metal for Vitreous Enameling . . . Deep Drawing Quality (in all grades, widths up to 91 inches) . . . Stran-Steel Metal Framing for Residential and Commercial Construction.

The Hanna Furnace Corporation

Merchant Pig Iron

Brands: Buffalo . . . Detroit . . . Susquehanna

Grades: Foundry . . . Malleable . . . Ferro-Silicon . . . Silvery

NATIONAL
·STEEL·

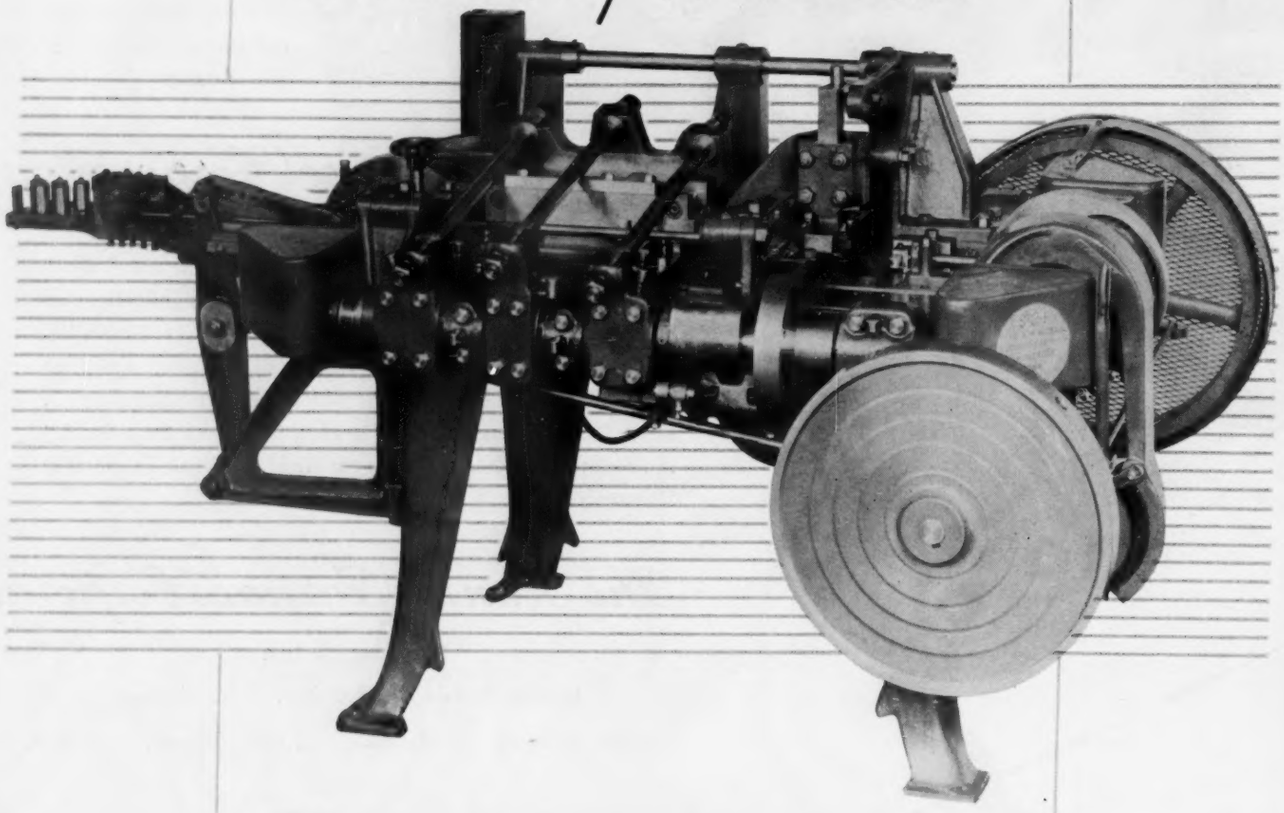
DIVISIONS

Weirton Steel Company
Weirton, W. Va.

Great Lakes Steel Corporation
Detroit, Mich.

The Hanna Furnace Corporation
Buffalo, N.Y.; Detroit, Mich.

NILSON *Automatic* WIRE AND METAL *Forming Machine*



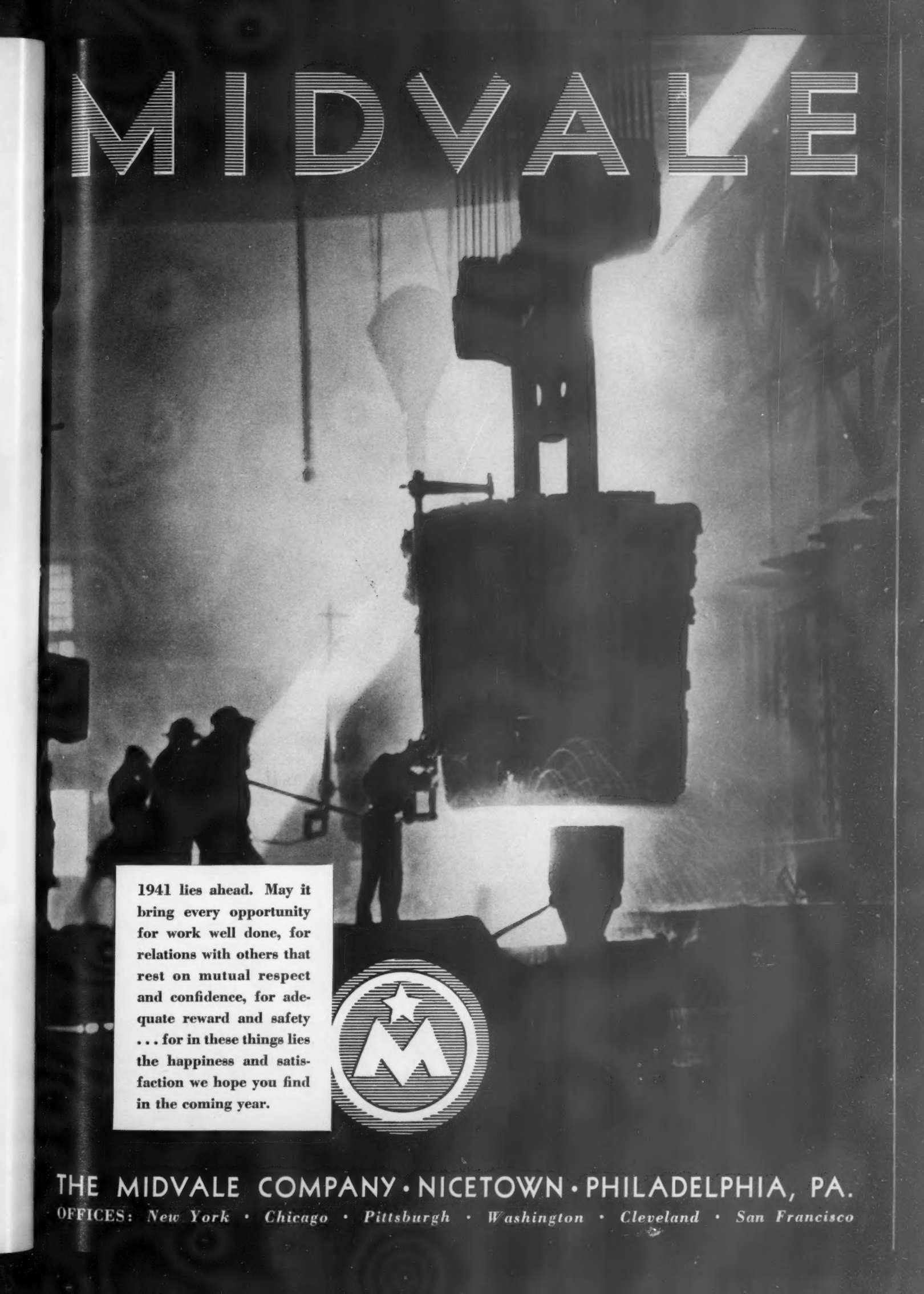
The first NILSON STOCK FORMING MACHINE was built over 50 years ago. It was a clumsy affair compared with the sleek models NILSON makes today, but it served its purpose. From this start NILSON went on to build machines for forming wire and metal parts, and the accumulated experience gained over a period of more than half a century is reflected in new records in speed and uniformity of products.

The NILSON four-slide forming machine illustrated here is a motor driven unit, with power operating wire feed transmitted through a straight line. The open construction of the press and forming tools permits access and visibility, and the patented slide feed has an independent cam-operated wire gripping device.

NILSON machines are guaranteed throughout. They are made for speedy and accurate production, with an eye toward the reduction of manufacturing costs.

THE *A. H. Nilson* MACHINE CO.

BRIDGEPORT — — — CONNECTICUT


MIDVALE
1941 lies ahead. May it bring every opportunity for work well done, for relations with others that rest on mutual respect and confidence, for adequate reward and safety . . . for in these things lies the happiness and satisfaction we hope you find in the coming year.
THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA, PA.
OFFICES: New York • Chicago • Pittsburgh • Washington • Cleveland • San Francisco

Designed, built and tested as a *Gearmotor*

WESTINGHOUSE DOUBLE-REDUCTION GEARMOTOR
Building both gears and electric drive in its own plants enables Westinghouse to furnish gearmotors that will handle full motor torque.
POSITIVE SPLASH LUBRICATION—assures trouble-free operation of drive.
SPLIT CASING—gives easy access to rotating parts.
SLOW SPEED SHAFT—delivers exact hp and speed required.
COMPACT MOUNTING—readily installed in small space.
BALL BEARINGS—cut friction losses to minimum.

In the design and construction of Westinghouse Gearmotors, Westinghouse engineers do not consider the reduction gears and the electric drive as separate units. A Westinghouse Gearmotor is designed, built and tested as a complete slow speed drive—a drive in which all parts are matched to provide maximum performance. By building its own gears Westinghouse gives the geared drive exactly the characteristics necessary to get the highest efficiency possible from the complete unit.

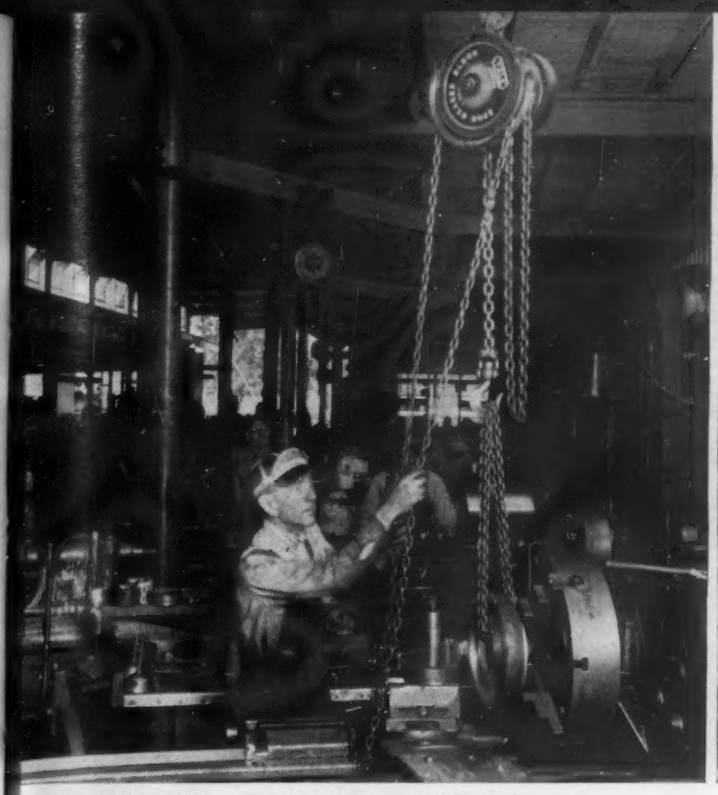
GEARMOTORS GIVE THE ADVANTAGE OF HIGH SPEED MOTOR EFFICIENCY & POWER FACTOR

Another advantage for the user is the fact that Westinghouse Gears are made of heat-treated, forged steel, cut by the hobbing process—the most accurate method of gear cutting yet devised. This assures quiet operation and the ability of the reduction gears to transmit the full torque of the motor under load and to withstand the shocks of severe service.

For complete information on how you can cut operating costs for your slow speed drive requirements, write or call Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

J-07180

Westinghouse
GEARED DRIVES



HAND CHAIN HOISTS Ball-Bearing Spur-Geared Hoists of this type are available in capacities from 300 lbs to 40 tons

ELECTRIC INDUSTRIAL TRUCKS . Capacities up to 50,000 lbs. A wide range of types includes multiple-lift, high-lift and low-lift models for every need. For different jobs there are platform, fork, dump, ram, load carrier, and crane trucks.

CONTROLLED Materials Handling brings lowered costs to Metal-Working Plants

EVERY plant today has a two-fold job to do: producing normal goods and services, and supplying materials for our national defense. As this task is executed, it's amazing to see how materials handling affects plant operations.

In studying problems of production, executives find that the key to lowered costs frequently lies in the control exercised over materials handling operations.

Materials handling is a broad term. But actually it resolves itself into the problem of lift and shift.

On this page we present four different types of modern materials handling equipment. While each is different in form and function, each is the ultimate in the efficient application of mechanized control over lift and shift. Each is a study of how to eliminate wasted time and effort, and to increase plant productivity.

Hand and electric hoists, hand lift trucks, and electric industrial trucks bring to handling jobs increased efficiency, reduced costs, minimum maintenance, maximum flexibility and availability, plus increased speed, greater safety and a continuous flow of the materials in production.

For specific details regarding any of this equipment, or for information concerning any materials handling problem, get in touch with, or write to, The Yale & Towne Manufacturing Company, Philadelphia Division, Philadelphia, Pa.

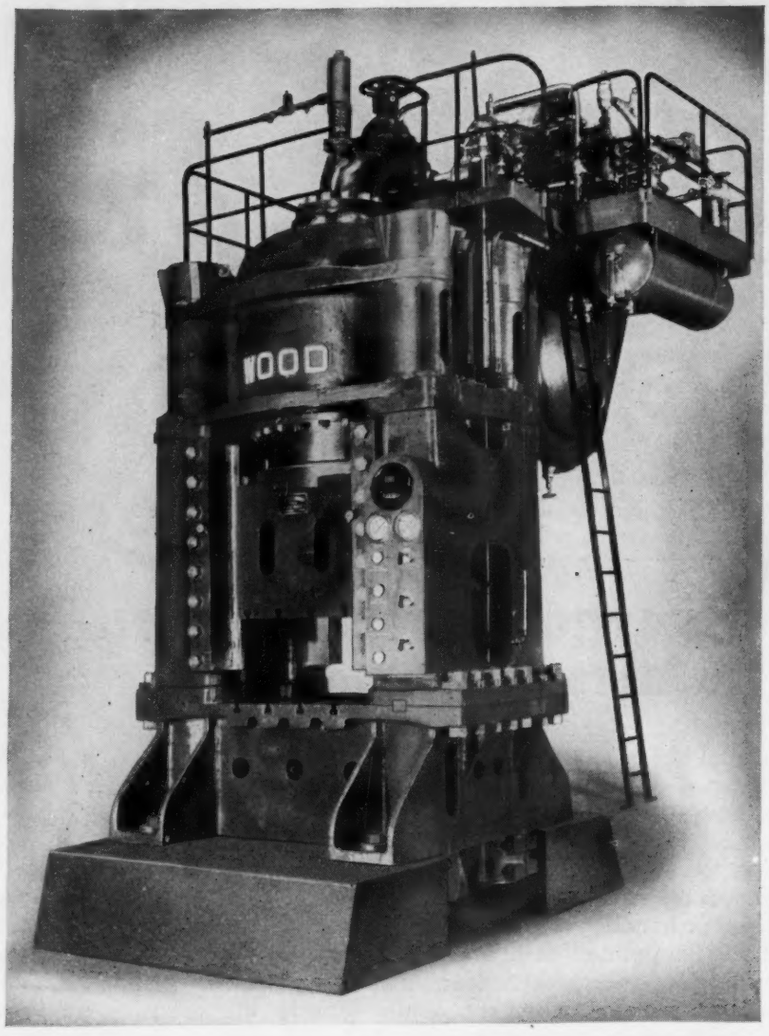
HAND LIFT TRUCKS Capacities up to 20.000 lbs. Single or multiple stroke lifts give these trucks an increased range of utility where heavier loads are concerned.

YALE

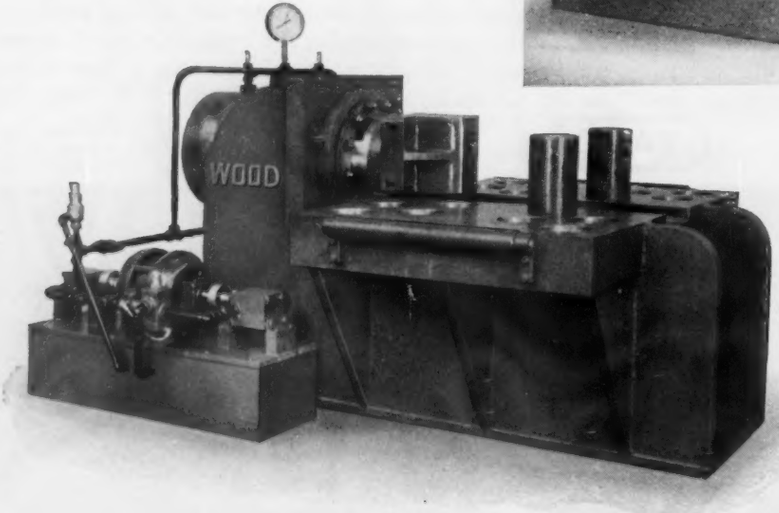
ELECTRIC WIRE ROPE HOISTS . . Capacities ¼ to 10 tons. Supplied in parallel and right angle suspensions in lug, hook, plain and motored trolley, close headroom and winch types.

PRODUCTION DEMANDS for 1941 are HEAVY...

. . . but rigorous production schedules are readily maintained with R. D. Wood presses and hydraulic valve equipment. The extra measure of strength, precision and performance that is built into all WOOD equipment is especially valuable in times like these. WOOD engineers are always available for a discussion of your press problems or requirements.



▲ The above 2000 ton high speed HydroLectric press is but one of many types of WOOD hydraulic units. The gib-guided crosshead provides high accuracy, and the motor-driven pump is located on top of the press for maintenance accessibility.



◀ This Horizontal Hydraulic Straightening Press, complete with motor-operated high and low pressure pumping equipment, is of 200 ton capacity. The press frame is of welded steel construction carrying a double-acting cast steel cylinder with working stroke of 12". The table is 52" x 72" and is provided with sixteen machined holes for 8" diameter bending pins.

...HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE

ESTABLISHED 1803

R. D. Wood Co.

PHILADELPHIA, PA.

CONTINENTAL AND SUPERIOR STEEL

Continental's output embraces a wide line of sheets and wire. Among the best known brands of coated sheets in the industry are CONTINENTAL and SUPERIOR. They are supplied in a wide range of specifications and in over 30 different kinds of surface treatments, finishes and coatings.

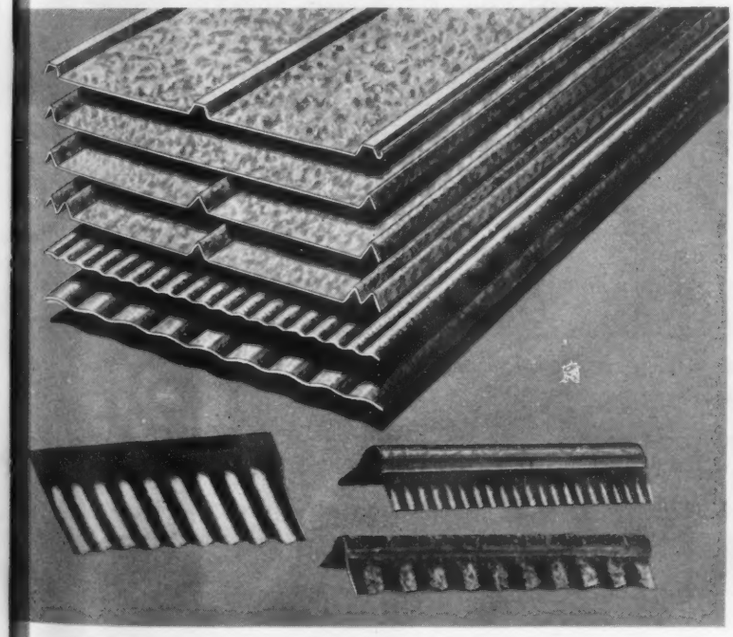
Even wider is the assortment of Continental wire and wire products. Continental manufacturer's wire is supplied in special analyses and KONIK steels in a variety of tempers, sizes and shapes; also in many finishes including bright, blued, sull, tinned, and coppered. In fence Continental offers 15 different types, among them Chain Link Fence, Lawn Fence, etc. Your inquiries are invited.

CONTINENTAL STEEL CORPORATION • KOKOMO, IND.

Plants at Kokomo, Indianapolis and Canton

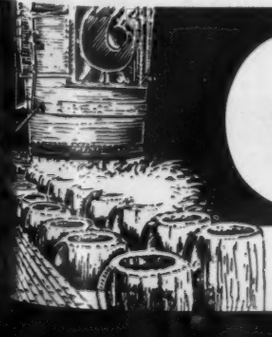
STEEL SHEETS—CONTINENTAL and SUPERIOR sheets are available in commercial and copper bearing steel and a variety of surface finishes and coatings—galvanized, special coatings, "tite", etc.

MANUFACTURERS WIRE—Continental specializes in low carbon wire. This wire is supplied to meet a wide range of specifications for tempers, sizes and finishes.



STEEL ROOFING AND ACCESSORIES—There are 14 styles of Continental steel roofing including corrugated, 2, 3 and 5 "V-Crimp", "Drainrite" and TYL-LYKE, all galvanized by the SUPERIOR process.

CHAIN LINK FENCE—Extensively used for protection of industrial plants, parks, schools and institutions. The fabric is made of KONIK steel for greater strength and rust resistance.



CONTINENTAL STEEL CORPORATION

SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Long Terne, etc.

CHAIN LINK FENCE, NAILS, FARM FENCE, GATES, POSTS, STEEL ROOFING.

WIRE: Bright Basic, Annealed, KONIK, Special Manufacturer's, Barb Wire, etc.

DEPENDABILITY

and superiority of "TRANTINYL" ALLOY STEELS *are facts recognized in the rolling mill industry. Long life and freedom from "pick-up" are characteristics of* "TRANTINYL" *which result in*

REDUCED COST
INCREASED YIELD
IMPROVED QUALITY

Don't lift your eyebrows when we tell you that the new "Trantinyl" guides will last TEN TIMES as long as the ones you are now using. Make us prove it! In all instances where "Trantinyl" has been used, tonnage went up and scrap came down; moreover, every user has broken his own guide tonnage record. We will give you case histories that will warrant your trying these revolutionary guides. BUT BETTER THAN THAT, we will furnish you with trial guides, gratis, in order to substantiate these unusual claims.

TRANTINYL — QUALITY DISTINCTION

SEAMLESS TUBE MILL: Guide Shoes - Plugs - WELDED TUBE MILL: Rolls - Plugs
Miscellaneous Castings - BAR, SHAPE AND STRIP MILL: Guides - Rollers

YOUNGSTOWN ALLOY CASTING CORPORATION

Youngstown, Ohio, U.S.A.

TWO WAYS
TO FINISH A HARDENED GEAR

Take, for instance, a 12" gear with a 2" face, hobbed with ample stock for the correction of both hobbing and fire distortion errors. Its final overall error must not exceed .001".

METHOD A:

SPUR GEARS ONLY

Hob • Harden Grind

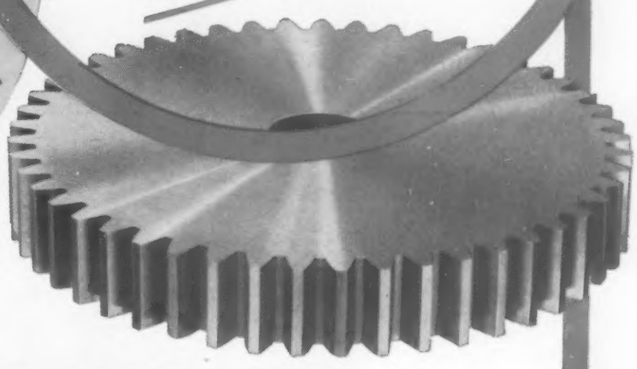
TOTAL MACHINE TIME
204 MINUTES

METHOD B:

SPUR OR HELICAL GEARS

Hob • Shave Harden • Lap

TOTAL MACHINE TIME
104 MINUTES



AND THAT'S NOT ALL

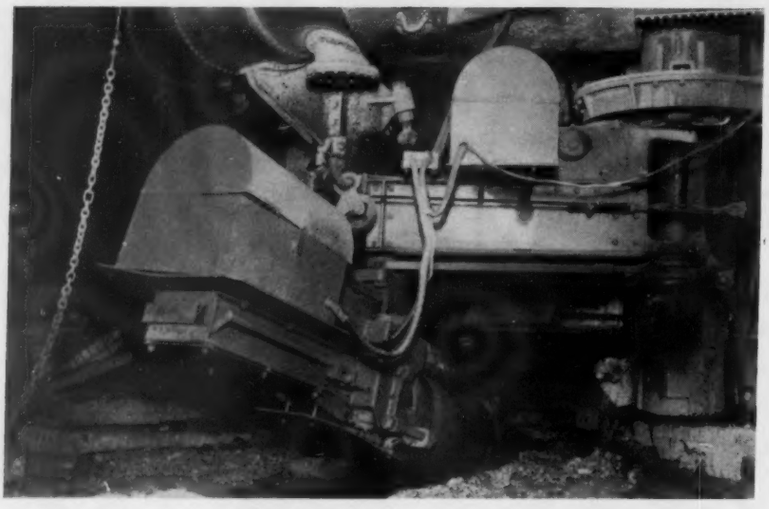
Method A is not only far more expensive but results in a high percentage of scrap due to surface checking of the teeth. It was abandoned years ago by practically all progressive automotive manufacturers and replaced by Method B which leaves the tooth surface unchecked and with a smoother, more accurate surface. Men responsible for production results are not inclined to do a job the wrong way, especially when it costs more.

Red Ring Gear Shaving and Lapping machines are found wherever modern gears are produced economically.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT, MICHIGAN

THESE BROSIUS SPECIALTIES ARE HELPING THE STEEL INDUSTRY DECREASE COSTS AND INCREASE PRODUCTION



The Two Motor Automatic Mechanical Electric

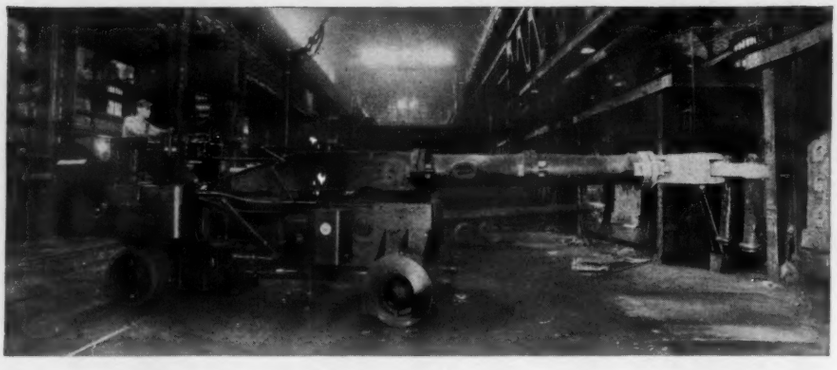
MUD GUN

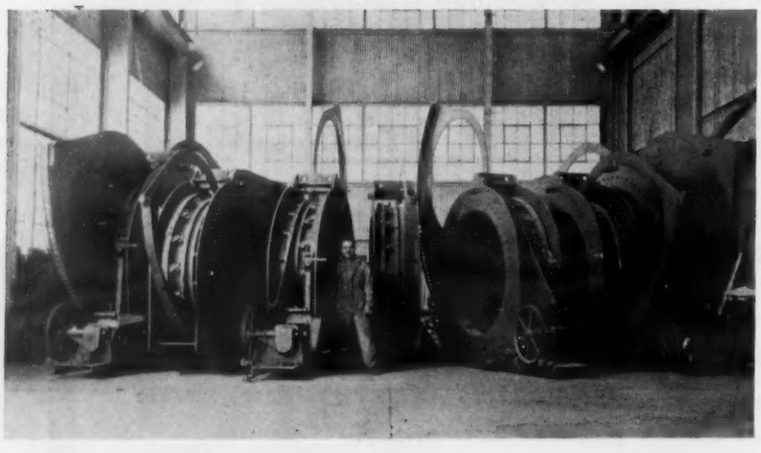
This latest design provides
INCREASED PRODUCTION
WITH GAS SAVINGS
and
Maximum Protection for
your men and furnace front

AUTO FLOOR CHARGING MACHINES

Solve your Charging and Handling Difficulties Quickly, Efficiently, Economically

Tongs Chargers, Manipulators, Box Chargers—Designed in Capacities of 2,000 to 20,000 lbs.





— Automatic —
Hand and Motor Operated

GOGGLE VALVES

Eliminate the Dangerous Hazards
In Controlling
Blast Furnace Gas with our
SIMPLE RUGGED Design

Edgar E. BROSIUS, Inc.

Designers and Manufacturers of Special Equipment for Blast Furnaces and Steel Mills

PITTSBURGH SHARPSBURG BRANCH PA.

Brosius Equipment is covered by patents allowed and pending in the United States and Foreign Countries

PRECISION BEARINGS

FOR EVERY LOAD, SPEED AND DUTY
108 DISTINCT SERIES
BALL, ROLLER AND THRUST
OVER 3000 SIZES
1/8" to 21" Bore — Metric and Inch Sizes
Write for the Catalog and Engineering Counsel
NORMA-HOFFMANN BEARINGS CORP'N.—STAMFORD, CONN., U. S. A.
"NORMA-HOFFMANN"
Separable (Magneto) Ball Bearing
Single Row Ball Bearing
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Single Felt Seal Ball Bearing
Double Felt Seal Ball Bearing
9000 Series (Feltless) Sealed Ball Bearing
"Cartridge" Fully Sealed, Refillable Type Ball Bearing
Double Row Ball Bearing
Extra Light Type Ball Bearing
Duplex Type (Two Direction) Angular Contact Ball Bearing
Angular Contact Ball Bearing
Single Direction Ball Thrust Bearing
Standard Cylindrical Roller Bearing
Double Row Self-Aligning Adapter Ball Bearing
Full Type (Retainerless) Cylindrical Roller Bearing
Extra Light Cylindrical Roller Bearing
Two-Lipped Cylindrical Roller Bearing
Double Row Self-Aligning Ball Bearing

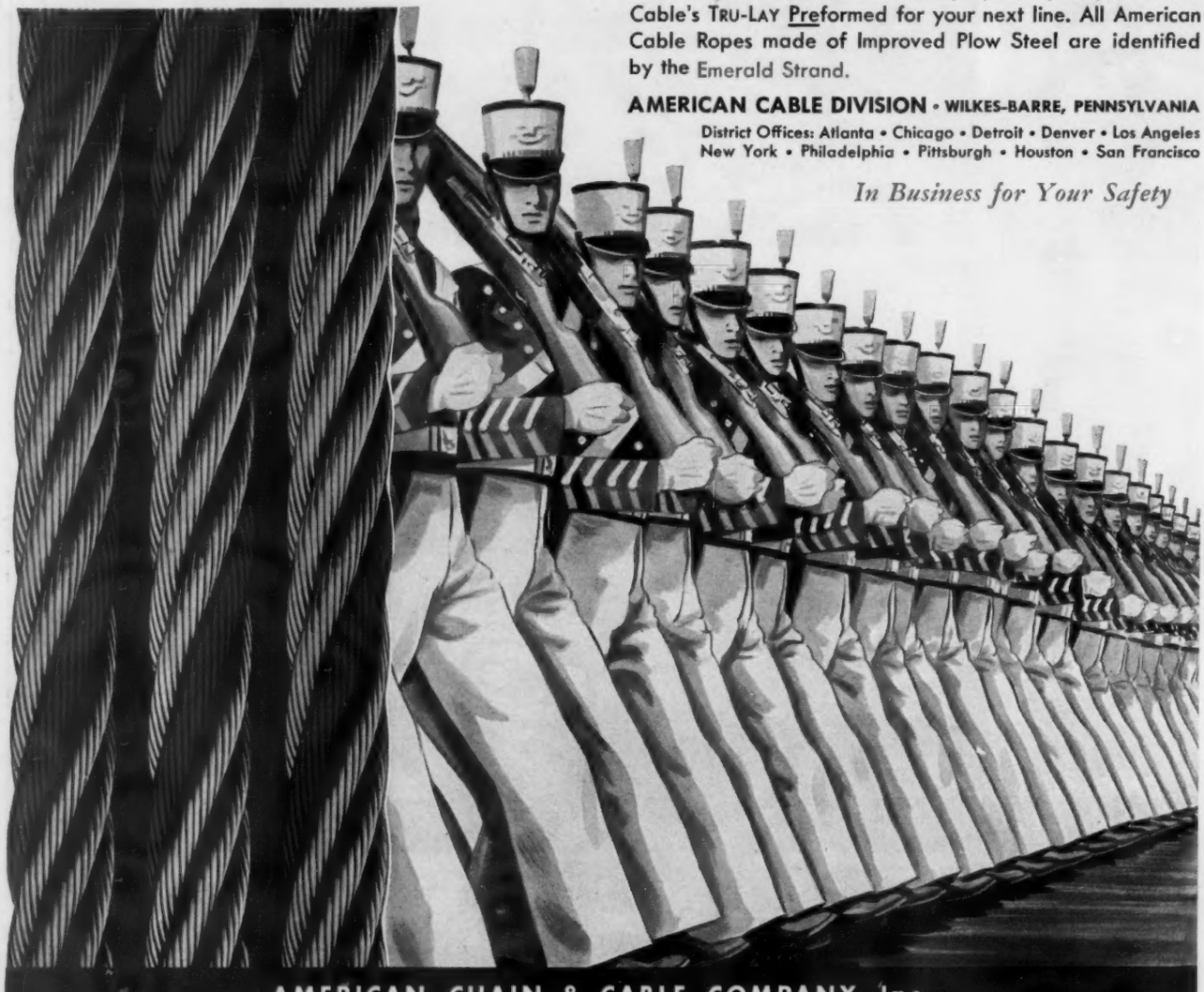
AMERICAN CABLE

TRU-LAY *Preformed* Wire Ropes ARE UNIFORM

UNIFORM IN QUALITY This is a universally acknowledged characteristic of American Cable's Wire Ropes.

UNIFORM IN SERVICE Being uniform in quality, American Cable's Ropes are naturally uniform in service. When American Cable introduced TRU-LAY Preformed, in 1924, we gave all industry a rope that far outlasted ordinary non-preformed, our own make included. Here, too, in increased service, there is uniformity for when one TRU-LAY Preformed Rope does a job unusually well, the second or twenty-second TRU-LAY Rope will do equally well.

UNIFORM IN SAFETY TRU-LAY Preformed is a safer rope. Its crown wires lie flat and in place so that there is less danger of their wickering out and jabbing workmen's hands, which often causes blood-poisoning. TRU-LAY handles easier and faster, resists kinking and whipping, spools on drums better and rotates less in sheave grooves. TRU-LAY requires no seizing when cut and will not fly apart. Specify American Cable's TRU-LAY Preformed for your next line. All American Cable Ropes made of Improved Plow Steel are identified by the Emerald Strand.



AMERICAN CABLE DIVISION • WILKES-BARRE, PENNSYLVANIA

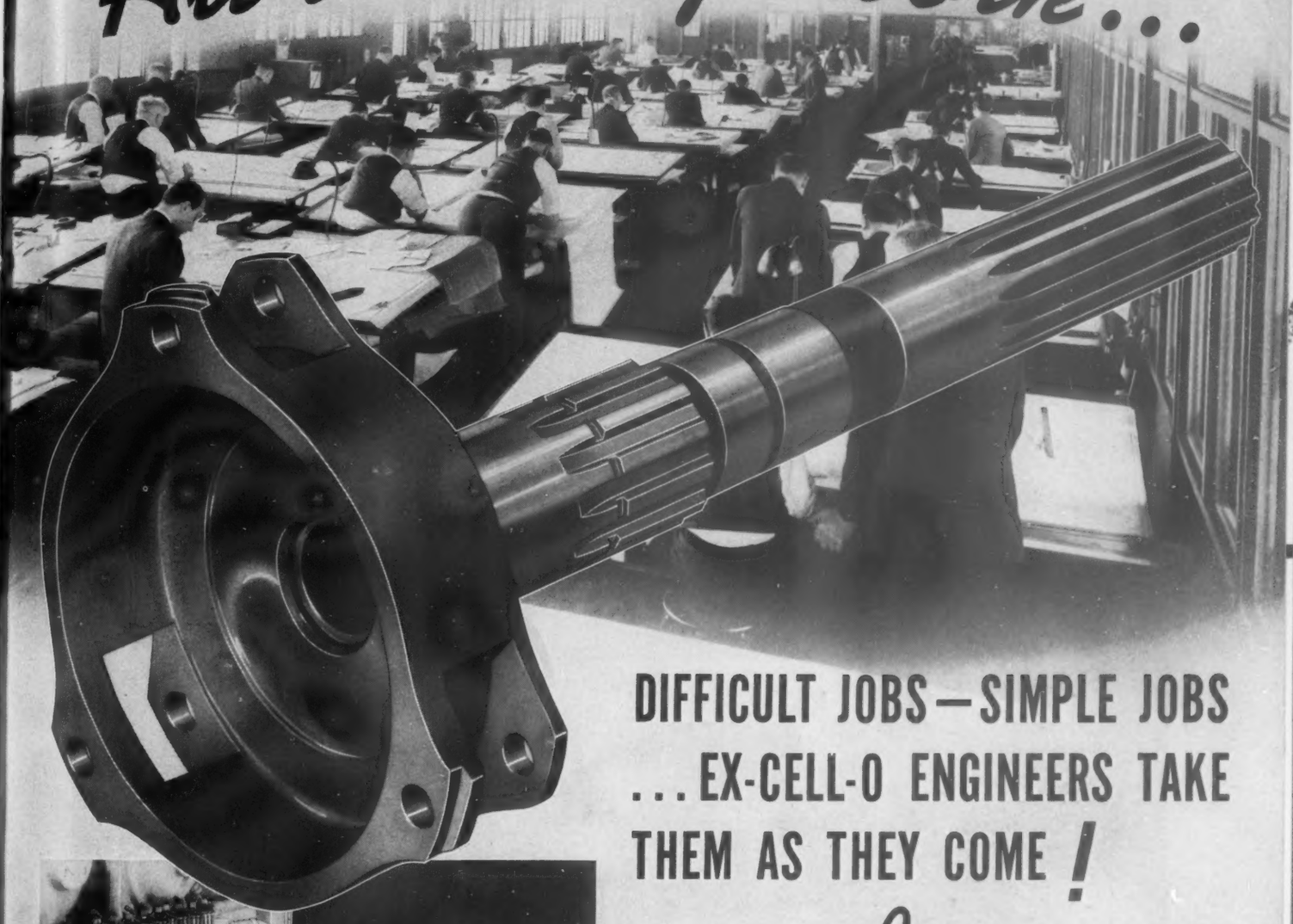
District Offices: Atlanta • Chicago • Detroit • Denver • Los Angeles
New York • Philadelphia • Pittsburgh • Houston • San Francisco

In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.

ESSENTIAL PRODUCTS . . . AMERICAN CABLE Wire Rope, TRU-STOP Emergency Brakes, TRU-LAY Control Cables, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Iron Castings, CAMPBELL Cutting Machines, FORD Hoists and Trolleys, HAZARD Wire Rope, Yacht Rigging, Aircraft Control Cables, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

All in a day's work...



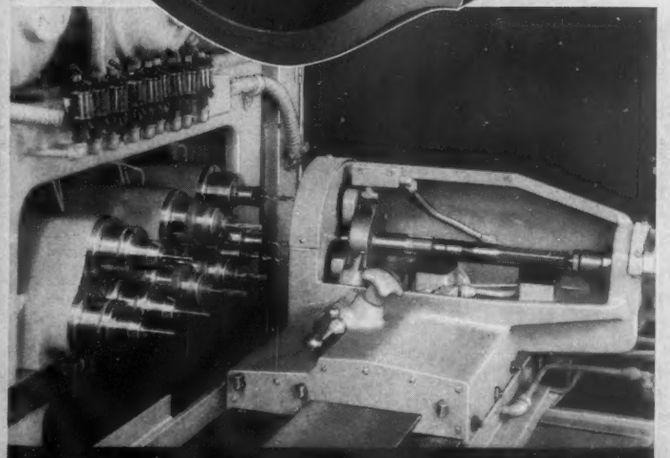
DIFFICULT JOBS—SIMPLE JOBS ... EX-CELL-O ENGINEERS TAKE THEM AS THEY COME!

PRODUCTION problems coming to Ex-Cell-O engineers from American industry in the course of a year are many and varied. Some are regarded by others as being so "tough" that they already are labeled as seemingly impossible. In almost every instance, Ex-Cell-O engineering experience and skill provide a practical solution by designing machines, fixtures, and tools to do a precision job ... with a minimum of operations ... on a money-saving, time-saving basis.

Other jobs are more simply solved, often by an application of a standard Ex-Cell-O precision machine and set-up that will at low cost give extreme accuracy and profitable production.

Whatever your metal-working problem in 1941 may be, if it is one requiring precision work, a good production rate, and profitable operation, it is to your advantage to consult Ex-Cell-O.

EX-CELL-O CORPORATION • DETROIT, MICHIGAN



One of the "tough" jobs recently accomplished by Ex-Cell-O engineers. Part is a heat-treated steel forging—a driven shaft used in new automatic transmission of nationally known automobile. On an Ex-Cell-O Precision Boring Machine (Style 112C) and especially designed fixture, holes for pinion gears are drilled, bored, and finish-reamed from the solid, with tolerances held to .0005", *and essential alignment satisfactorily maintained.* One Ex-Cell-O machine performs these operations, replacing four machines with four separate operations formerly required to do the job. The one Ex-Cell-O machine maintains the same total production as the four machines did before.

EX-CELL-O (XLO) Precision MACHINES AND TOOLS

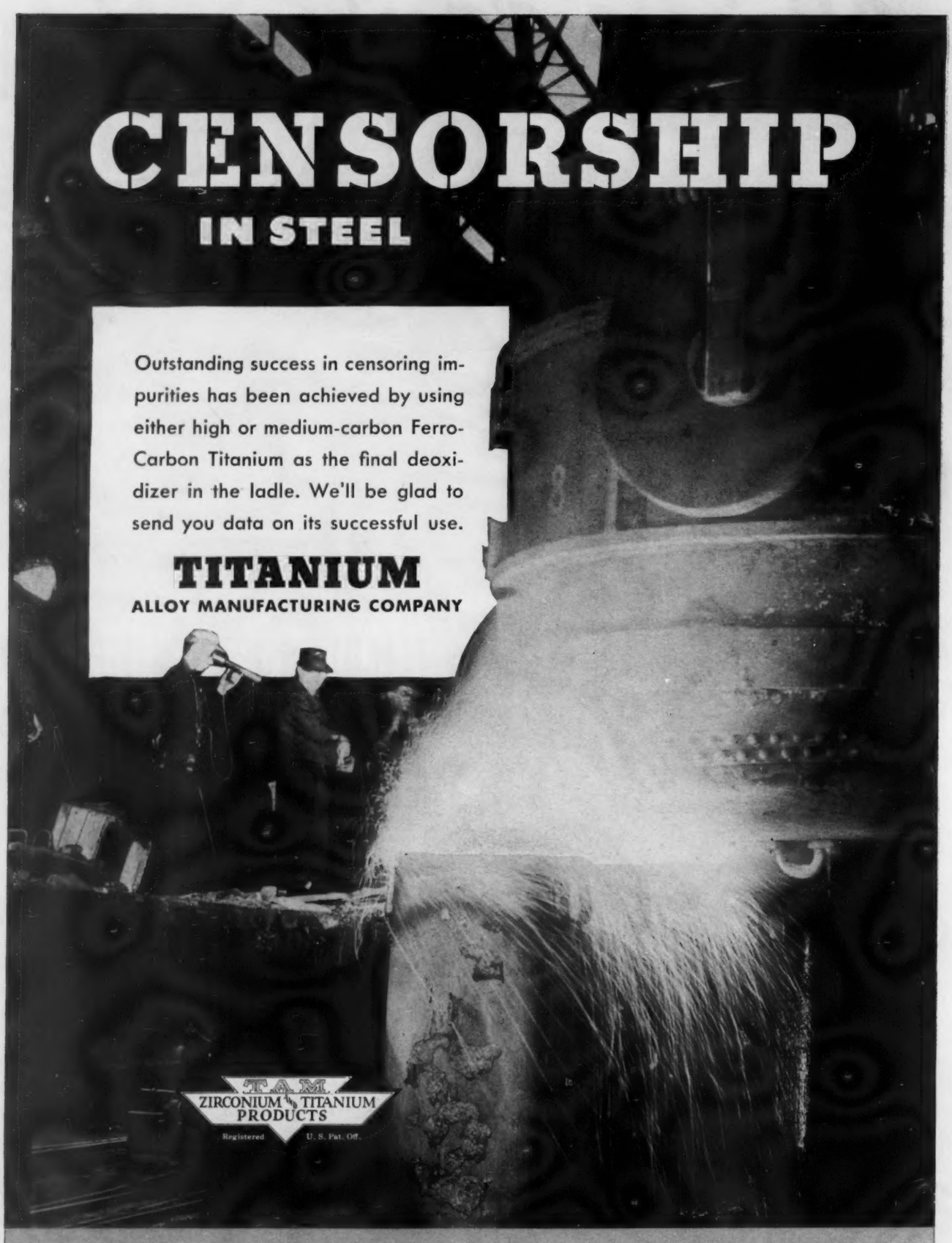
EX-CELL-O CORPORATION
1228 Oakman Blvd., Detroit, Michigan

Please send bulletins on Ex-Cell-O Precision Boring Machines.

Name_____ Title_____

Company_____

Address_____


CENSORSHIP
IN STEEL
Outstanding success in censoring impurities has been achieved by using either high or medium-carbon Ferro-Carbon Titanium as the final deoxidizer in the ladle. We'll be glad to send you data on its successful use.
TITANIUM
ALLOY MANUFACTURING COMPANY
T.A.M.
ZIRCONIUM TITANIUM
PRODUCTS
Registered U. S. Pat. Off.

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A.
EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

Representatives for the Pacific Coast . . . . Balfour, Guthrie & Co., San Francisco, Los Angeles, Portland, Seattle, Tacoma
Representatives for Canada . . Railway & Power Eng. Corp., Ltd., Toronto, Montreal, Hamilton, Winnipeg, Vancouver, Sydney
Representatives for Europe . . . . . T. Rowlands & Co., Ltd., 23-27 Broomhall St., Sheffield, England

New savings on amazing new
G-E MAZDA FLUORESCENT LAMPS

EVERY day the story of G-E MAZDA Fluorescent lamps grows more amazing. So swift has been the acceptance of this new, cooler, high-efficiency light source—so wide-spread has become its use throughout industry—so steady has been the development of new G-E manufacturing economies—that again General Electric announces lower prices. Again General Electric passes its savings along to you!

Now fluorescent light costs less than ever before. You can use more of it—to help speed production, step up sales, cut errors. You can have "windows of daylight" everywhere—better work with less eyestrain—daytime morale on the night shift! You can have the new higher levels of light needed to keep your business forging ahead—and have it at less cost than ever now.

Ask your electric service company or G-E MAZDA lamp distributor to help you choose the fixture best suited to your needs. And be sure you get G-E MAZDA "F" lamps. They're made to give maximum light for current consumed. *Made to stay brighter longer!*

Before you buy any type of FLUORESCENT LIGHTING ask yourself these questions:

1 Are you getting a wide enough choice of fixtures so that your fluorescent lighting meets your INDIVIDUAL needs?

2 Is the performance of the fixtures and ballasts and starters certified for best lighting results by Electrical Testing Laboratories?

3 Are you getting G-E MAZDA Fluorescent Lamps, which give all the efficiencies and economies of MAZDA Research?

NEW LOW PRICES ON G-E MAZDA "F" LAMPS

	Jan. 1st, 1941	
15-watt T-8 (*daylight or white*†)	was 95c	**NOW 85c**
20-watt T-12 (*daylight or white*†)	was $1.25	**NOW $1.10**
30-watt T-8 (*daylight or white*†)	was $1.25	**NOW $1.10**
40-watt T-12 (*daylight or white*†)	was $1.90	**NOW $1.60**
100-watt T-17 (*daylight or white*†) (recently introduced)	was $3.75	**NOW $3.50**

Prices also reduced on colored G-E MAZDA "F" *Lamps*

† *Standard white* (3500°K)

G-E MAZDA LAMPS
GENERAL ELECTRIC

Turn to

INGERSOLL

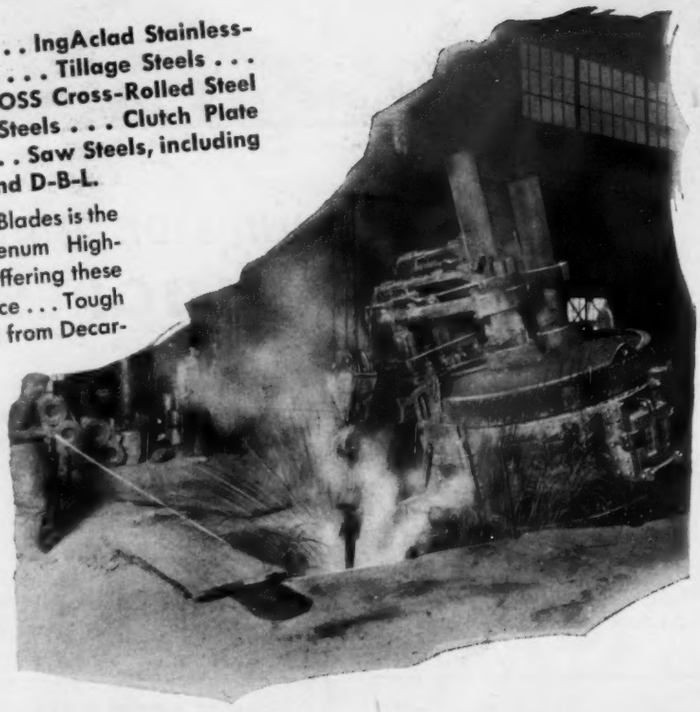
AS A DEPENDABLE SOURCE FOR SPECIAL STEELS

Memo to Purchasing Dept. See What Ingersoll offers

This Division of Borg-Warner Corporation specializes in "Steels for Special Uses." These include . . .

Armor Plate . . . Alloy Steels . . . IngAclad Stainless-Clad Steel . . . Stainless Steels . . . Tillage Steels . . . Soft Center Steels . . . TEM-CROSS Cross-Rolled Steel . . . Shovel Steels . . . Knife Steels . . . Clutch Plate Steels . . . High Speed Steels . . . Saw Steels, including "18-4-1" and Molybdenum and D-B-L.

Ingersoll *D-B-L Steel for Hack Saw Blades is the sensational new Tungsten-Molybdenum High-Speed Steel for Hack Saw Blades, offering these advantages: Higher Impact Resistance . . . Tough Cutting Edge . . . Relative Freedom from Decarburization . . . and Lower Cost. Specify Ingersoll D-B-L to cut your bills for Hack Saw Blades.



**Ingersoll D-B-L is produced under exclusive license arrangement with Allegheny-Ludlum Steel Corporation.*

Inquiries for all "Special Steels for Special Uses" are invited.

INGERSOLL
STEEL & DISC DIVISION
BORG-WARNER CORPORATION
NEW CASTLE, INDIANA

Plants: New Castle, Ind., Chicago, Ill., Kalamazoo, Mich.

INGERSOLL STEELS

"PRODUCTS OF BORG-WARNER CORPORATION"

NEW YORK WORLD-TELEGRAM, TUESDAY, NOVEMBER 26, 1940.

Toughening Up Process for America's Future War Planes

The world's largest battery of furnaces for nitriding—a process which develops one of the hardest steel surfaces known— are toughening airplane cylinder barrels in the Paterson, N. J., plant of the Wright Aeronautical Corp. In this photo the cylinder barrels are being lowered into the furnace. Acme Photo

Encased in sealed containers the barrels enter one of the seven furnaces which can treat 35 tons of parts at a time. When three receptacles are heat treated, the furnace moves on rails to the next three. The plant is the first in this country to adopt line production of aircraft engine parts.

Britain Make... Bid | Congr...
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Roosevelt Calls ...
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A FEW STANDARD APPLICATIONS OF NITRALLOY

Calender Rolls
Cams and Camshafts
Chain Links and Pins
Connecting Rods
Crankshafts
Cylinder Liners
Die Casting Dies and Cores
Fan Blades
Fuel Injector Parts
Gears
King Pins
Pinions
Piston Rods and Rings
Pump Rotors and Sleeves
Push Rods
Scale Balances
Scale Blocks
Seaming Rolls
Seats for Valves
Shackle Bolts
Shafts
Sockets
Spindles
Splines
Sprockets
Steering Worms
Tappets
Valve Gauges
Valve Seat Rings
Valve Stems and Sleeves
Water Pump Shafts
Worms
Wrenches
Wrist Pins

Companies Licensed by The Nitralloy Corporation

Allegheny Ludlum Steel Corp.	Watervliet, N. Y.
Bethlehem Steel Co.	Bethlehem, Pa.
Crucible Steel Co. of America	New York, N. Y.
Firth-Sterling Steel Co.	McKeesport, Pa.
Republic Steel Corporation	Cleveland, Ohio
The Timken Roller Bearing Co.	Canton, Ohio
Vanadium-Alloys Steel Co.	Pittsburgh, Pa.

Operating and Accredited Nitriding Agents

Camden Forge Co.	Camden, N. J.
Commercial Steel Treating Corp.	Detroit, Mich.
The Lakeside Steel Improvement Co.	Cleveland, Ohio
Lindberg Steel Treating Co.	Chicago, Ill.
Link-Belt Co.	Philadelphia, Pa.
Met Lab, Inc.	Philadelphia, Pa.
New England Metallurgical Corp.	Boston, Mass.
Pittsburgh Commercial Heat Treating Co.	Pittsburgh, Pa.
Queen City Steel Treating Co.	Cincinnati, Ohio
Wesley Steel Treating Co.	Milwaukee, Wis.
Ontario Research Foundation	Toronto, Ontario, Canada

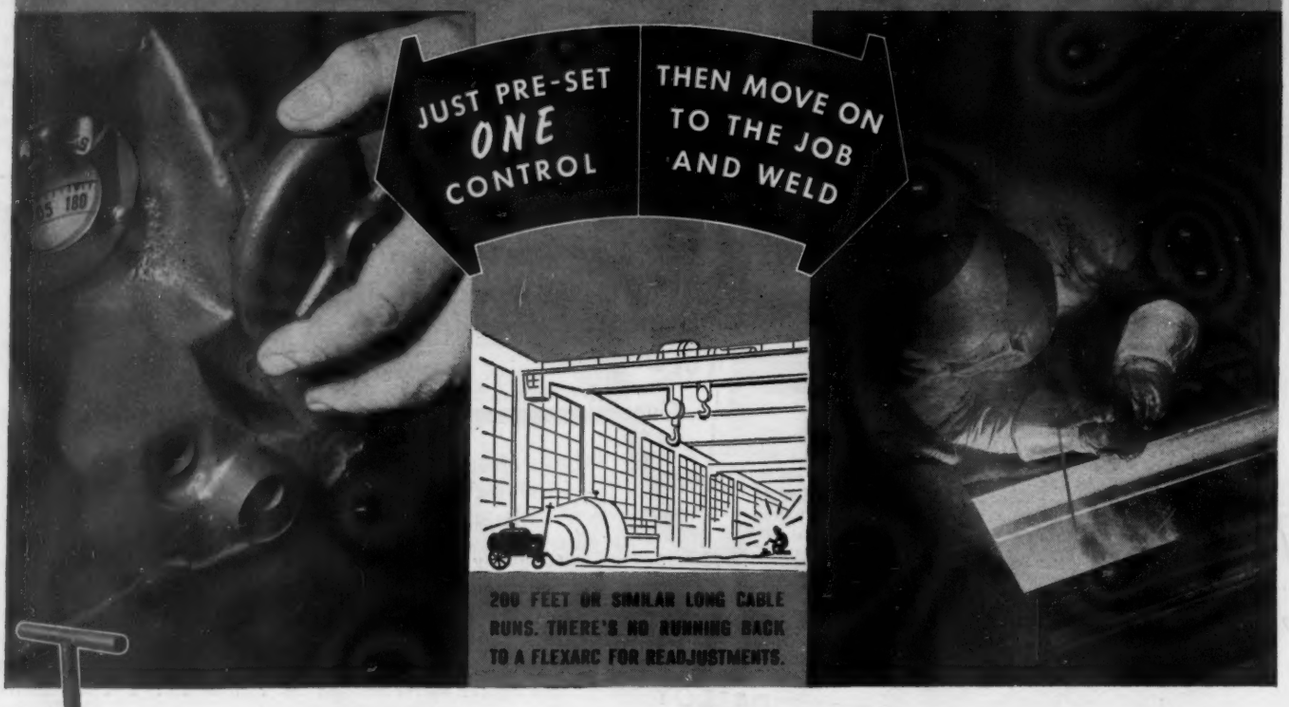
NITRALLOY

THE HARDEST KNOWN STEEL SURFACE FOR WEAR RESISTANCE!

THE NITRALLOY CORPORATION 230 Park Avenue, New York City

Before you Buy any Welder

MAKE THE FLEXARC 200 FOOT TEST



Here's a real showdown! Rent a Flex-Arc. Easy terms — no obligation to buy. Rental can be applied against purchase price.

See your FlexArc dealer today and tell him you want to make the FLEXARC 200-FOOT TEST. Then be prepared for a new thrill in arc welding.

Pre-set FlexArc's one control—step away 200 feet, or any distance you choose—and strike your arc.

See what a rock-steady arc FlexArc gives you. Note that there's no need to return to the welder for readjustments—either immediately after warm up, or for different positions of the rod. FlexArc controls the arc for you—perfectly, and automatically.

Here's the capacity to lay metal faster than you ever did before—to spend 60 seconds of every minute welding, not walking—to make better welds because the arc is always right. Isn't that exactly what you want in a welder? . . . then try the 200-FOOT TEST.

WESTINGHOUSE ELECTRIC & MFG. CO.
DEPT. 7-N EAST PITTSBURGH, PA.

J-21058

Westinghouse Flexarc Welders

W
WESTINGHOUSE ELECTRIC

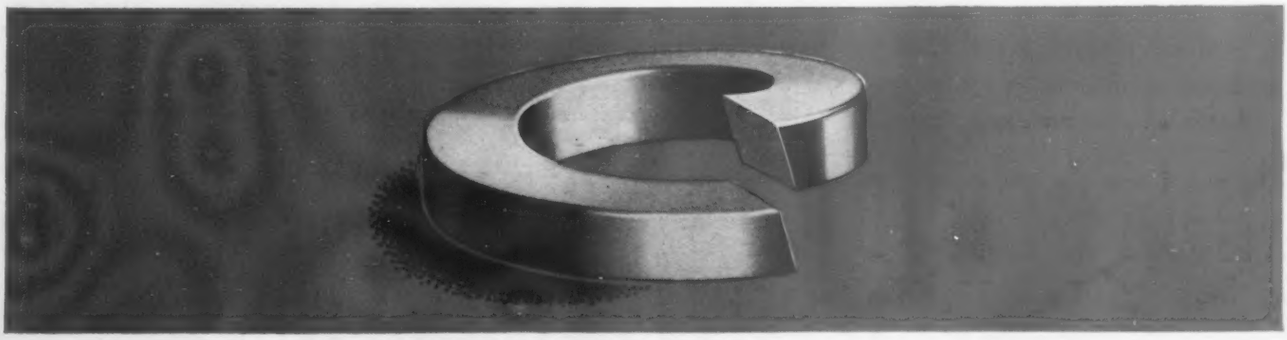
. . . and only one answer to keeping bolted parts tight!

KANTLINK Helical Spring Washers do the job better—*at less cost!*

The puzzle of keeping bolted parts tight has only one answer . . . *maintaining adequate pressure on thread surfaces over a long range.* A nut or screw cannot turn backward on its threads *unless and until* pressure has been lessened by bolt stretch, wear under the nut and bolt head, or pulverizing of paint, rust or scale. A KANTLINK Helical Spring Washer is *the* device that compensates for these causes of looseness by maintaining pressure *over a long range.* It has far more range of action than other so-called locking devices . . . *and it costs less!*

KANTLINK HELICAL SPRING WASHERS • WRIGLEY BUILDING • CHICAGO

Specify KANTLINK Helical Spring Washers



HUTHER SAWS

FIRTHITE TIPPED SAWS

FIRTHITE-TUNGSTEN CARBIDE, made by Firth Sterling Steel Corp., is used for tipping this saw. For cutting non-ferrous metals, fibres, plastics, etc. Write for full information.

• ● •

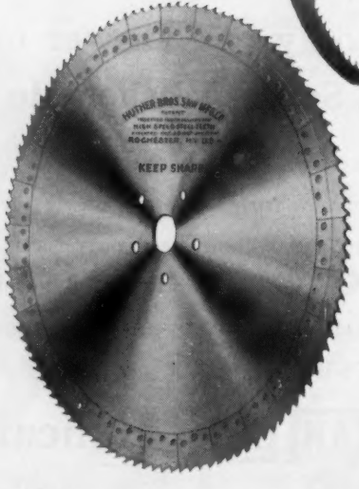
Segment with Firthite tips for Huther Bros. Patent Inserted Tooth Saw.

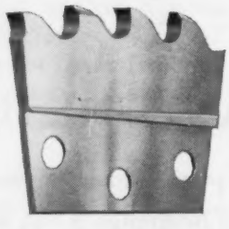
Huther Bros. Patent Inserted Tooth Milling Saw with inserts of best quality High Speed Steel, the ideal saw for cutting brass, copper, and aluminum, leaves cut perfectly smooth —a real production tool. Saw has side clearance, sharpen on top of tooth only. Let us tell you more about this saw.

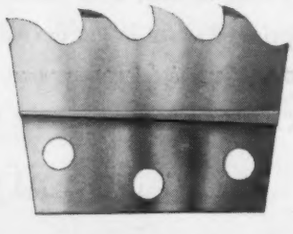
HUTHER SEMHI

TRADE MARK

HARD EDGE METAL CUTTING BAND SAW







HUTHER BROS. PATENT INSERTED TOOTH MILLING SAW

The wear is equal to about two inches on the diameter and the special heat treatment given these inserts—which are the best quality high speed steel—insures longer runs between sharpenings.

This is a saw that means real economy for the user. May be sharpened on automatic saw sharpener.

HUTHER BROS. SAW MFG. CO.

ROCHESTER, N. Y.

This machine is ideal for cutting shell stock and other steels and for cropping the ends of shell forgings . . . The square, clean cross-sections will show imperfections in the material.

Capacity—up to 9⅝" round or 8⅝" square with 28" blade and 10⅝" round or 9⅝" square with 30" blade.

Now

AN AMERICAN-MADE COLD SAWING MACHINE *that gives*

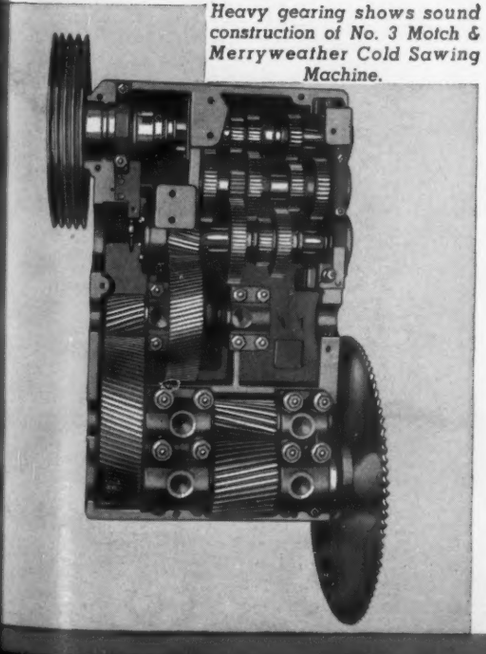
SQUARE CUTS

GREAT SPEED

NO BURRS

THE MOTCH & MERRYWEATHER

No. 3 HYDRAULIC FEED COLD SAW • • •



Heavy gearing shows sound construction of No. 3 Motch & Merryweather Cold Sawing Machine.

● The Motch & Merryweather No. 3 Hydraulic Feed Cold Sawing Machine embodies basic principles of design long accepted by the trade. To them have been added many refinements originated and perfected by our own staff. Rigidity and accuracy are combined with high production. Nine saw blade speeds range from 18 to 134 feet per minute. The Vickers hydraulic low pressure system is operated by a 2-hp. motor; the head, by a 10-hp. motor. Heat-treated alloy steel spur and helical gearing consume little power. Timken bearings, automatic oiling, twin-disc clutch, complete control, and correct belt tension are other features. Users in England, Canada, South Africa, and the East Indies, as well as the United States, prefer the Motch & Merryweather cold saw for its solid, square cuts without chatter or burr, its great speed, and minimum upkeep. *Note:* extra blades in standard 28" and 30" oversize are available. Write for complete descriptive bulletin.

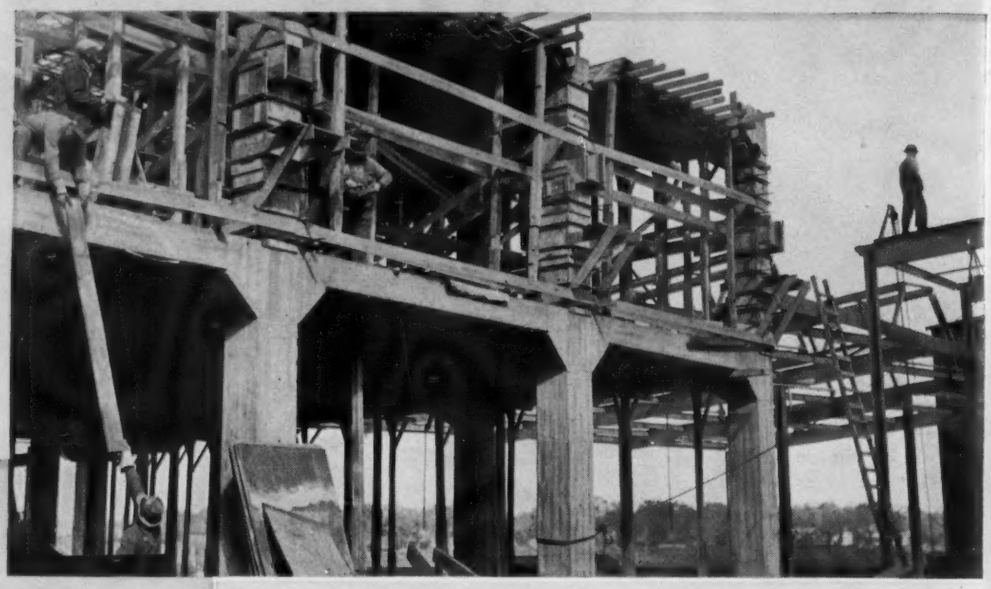
THE MOTCH & MERRYWEATHER MACHINERY COMPANY

715 Penton Building • • • Cleveland, Ohio

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER MACHINERY CO
CLEVELAND CINCINNATI DETROIT PITTSBURGH

PREPAREDNESS



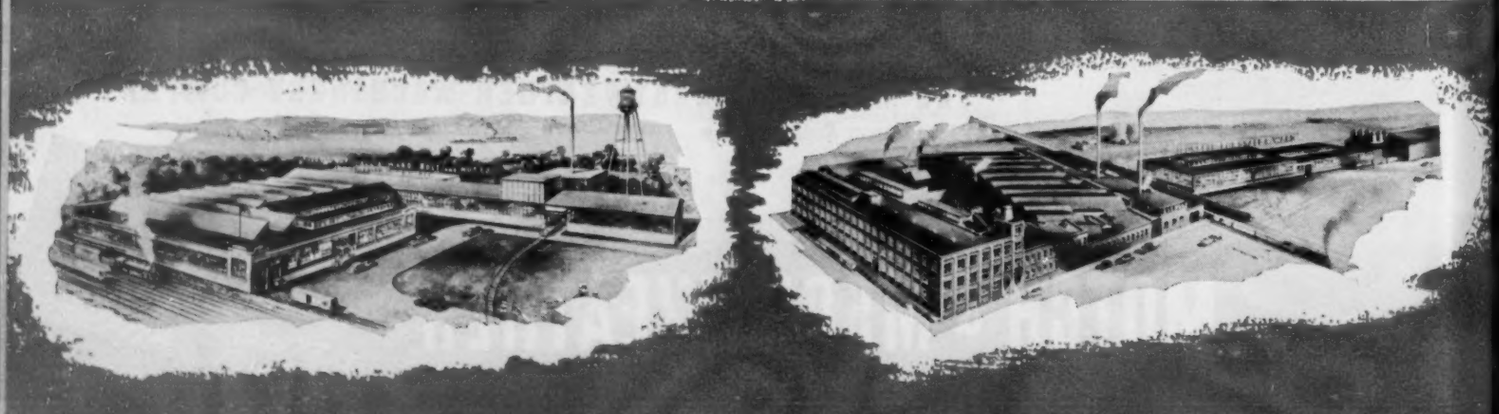
Below—Interior and exterior views of plants at Coraopolis, Pa., Rock Falls, Ill. and Port Chester, N. Y.

For over 95 years, RB&W has met the demands of industry — during other armament periods and manufacturing peaks where quality and service were essential to national emergency.

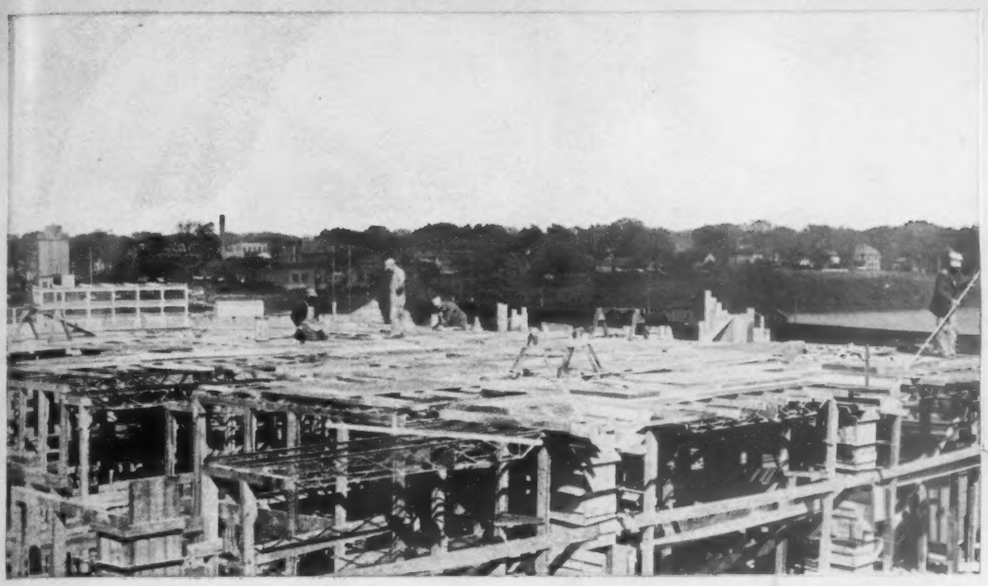
Since 1845, RB&W has answered each call through added plant facilities and increased production—yet ever kept in mind those fair policies and co-operative trade relations due to old customers, as well as new, and continued to build good will while meeting increased demands.

RUSSELL, BURDSALL BOLT

PLANTS AT PORT CHESTER, N. Y.



FOR 1941 DEMANDS



At left—Two views of plant expansion being completed at present time.

In 1941, RB&W is again prepared. New buildings and additional equipment have been added, and are still being added, to three large and strategically located plants. Immense supplies of raw materials have been acquired, and reserves of large, well assorted stocks of finished products are being maintained.

Thus, as usual, RB&W is in an enviable position to help those needing stable facilities for EMPIRE Bolts, Nuts, Rivets, and other Threaded Industrial Fastenings.

BOLTS: Carriage - Machine - Lag - Plow - Stove - Elevator - Step - Tap - Wheel & Rim - Battery - U-Bolts - Tire - Automotive - Drilled - Faced - Special Heat Treated, etc. - **NUTS:** Cold Punched - Semi-Finished - Hot Pressed - Case Hardened - Slotted - Castle - Machine Screw - Marsden Lock - Low Sulphur - **RIVETS:** Standard - Tinners' - Coopers' - Culvert - Clevis and Hinge Pins - **SCREWS:** Cap - Machine - Hanger - Sheet Metal - Phillips Recessed Head - **WASHERS:** Plate - Burrs - **MATERIALS:** Steels - Alloys - Non-ferrous Metals - Brass - Bronze - Everdur - Herculoy - and others - **RODS:** Stove - Seat - Ladder - **PLATED PARTS:** Cadmium - Zinc - Chromium - Nickel - Hot Galvanized - Copper - Tin - **SPECIAL UPSET & PUNCHED PRODUCTS.**

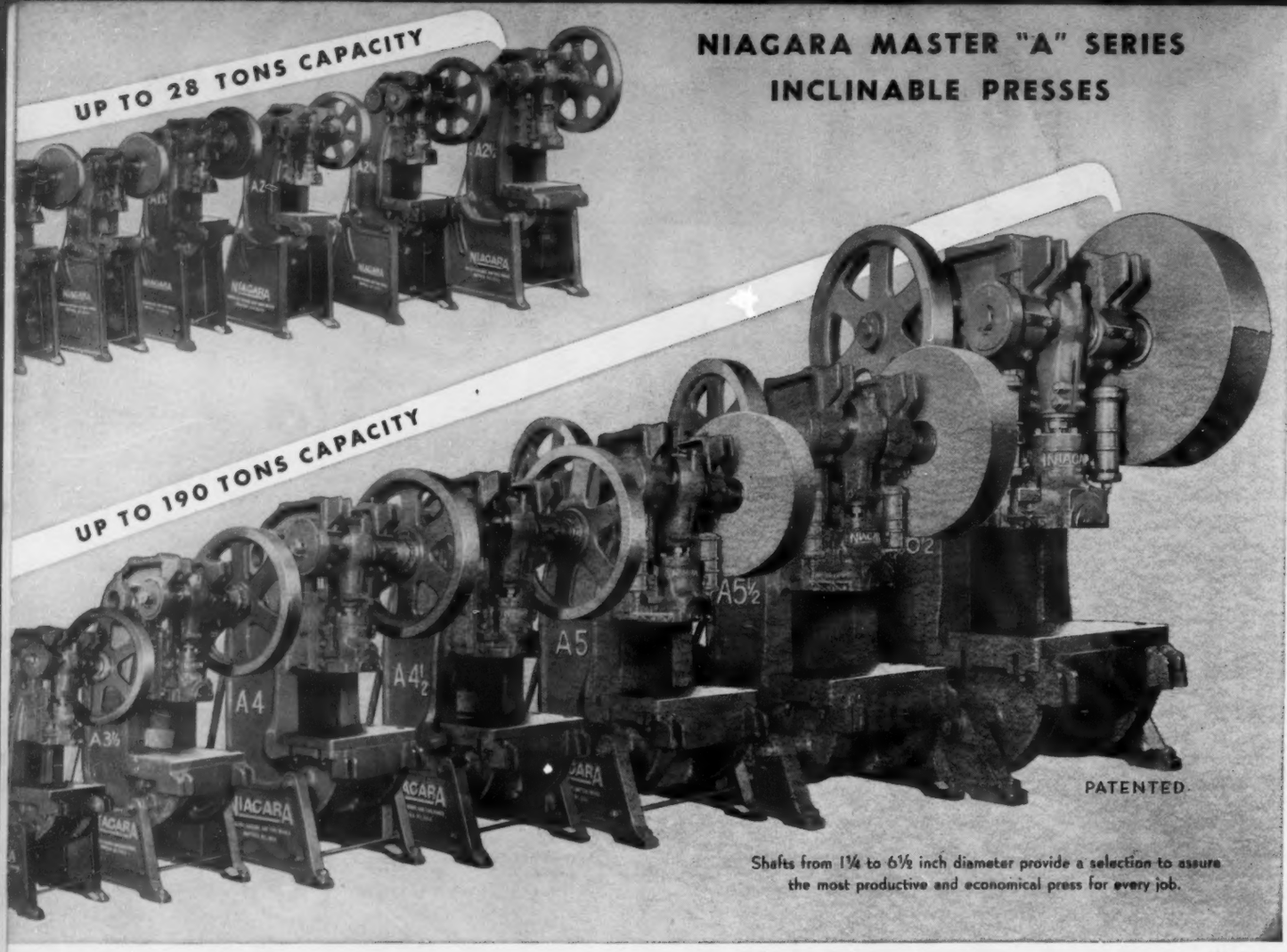
& WARD
AND NUT COMPANY

ROCK FALLS, ILL. **CORAOPOLIS, PA.**

BOLTS
EMPIRE
NUTS-RIVETS

994

NIAGARA MASTER "A" SERIES INCLINABLE PRESSES



Shafts from 1¼ to 6½ inch diameter provide a selection to assure the most productive and economical press for every job.

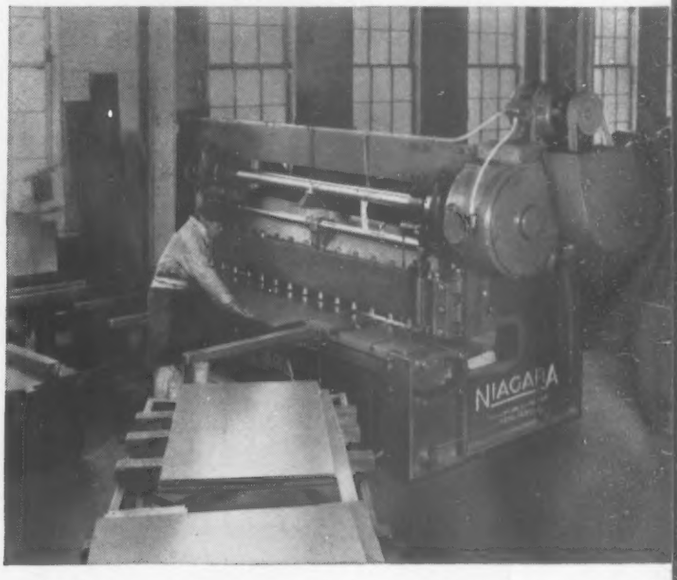
America's foremost industries including steel mills and warehouses, aircraft, ordnance, shipbuilding, automotive and other plants are speeding up production with Niagara Presses, Shears and Machines for plate and sheet metal work. The illustration above shows the well-graduated line of Niagara Open Back inclinable Presses. Other types include Single and Double Crank Presses, Horn Presses and Machines for blanking, drawing and forming. Bulletins covering all Niagara Presses are available upon request.

Latest type Niagara Power Squaring Shears shown below are built in cutting lengths from 6 to 18 feet . . . capacities 10 gage to ½-inch. Features include accurate, flat cutting. . . more working strokes per hour . . . convenient handling of stock and off-cut . . . instant acting 14 point sleeve clutch and gears mounted on anti-friction bearings and enclosed in oil tight case, self-measuring, ball bearing, parallel back gage. Write for Bulletins. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Branches: Cleveland, Detroit, New York.

Emergency demands for defense equipment have focused attention on the proven ability of Niagara Presses to deliver more working strokes per hour. Niagara production and economy are multiplied by thousands of presses throughout the industry.

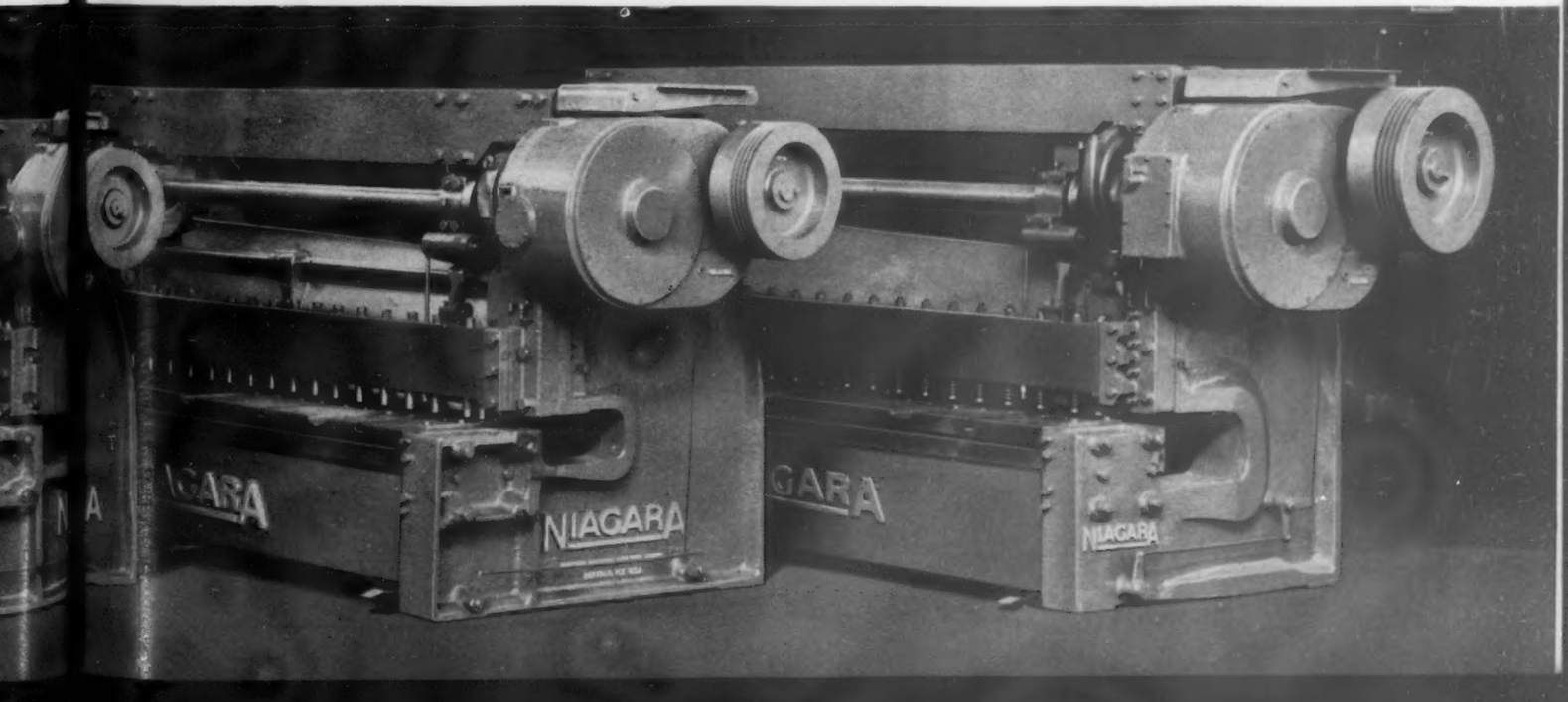
This line-up of Niagara Open Back Inclinable Presses is typical of how America's leading aircraft plants are putting plane manufacturing on a production basis—another example of modern industry using modern Niagara Presses.

Progressive operations in manufacturing automotive parts in large volume are being performed by Niagara Presses. This photograph is typical of many production set-ups in large plants everywhere.



With shearing to size a basic operation in sheet metal working, Niagara Power Squaring Shears are used by aircraft and tank manufacturers, steel warehouses and industries requiring accurate, flat cutting of sheet steel and plate for their products.

—Advt.



Photograph shows a 19' Tower fabricated from Worth Sheared Steel Plates—ready for delivery.

fabricated from

WORTH SHEARED STEEL PLATES

WORTH

WORTH STEEL COMPANY
CLAYMONT, DELAWARE

NEW YORK, N. Y., Wm. C. Dickey • PITTSBURGH, PA., McKee-Oliver, Inc. • ST. LOUIS, MO., Hubbell & Co. • SAN FRANCISCO, CALIF., W. S. Hanford • HOUSTON, TEXAS, The Corbett-Wallace Corp. • CLEVELAND, OHIO, E. F. Bond • DETROIT, MICH., H. L. Sevin • LOS ANGELES, CALIF., Ducommun Metals & Supply Co. • SEATTLE, WASH., Barde Steel Company • PORTLAND, OREGON, Barde Steel Company • MONTREAL and TORONTO, CAN., Drummond, McCall & Co., Ltd.

Eagle Insulating Materials meet a wide range of temperature and operating requirements in mills and factories

EAGLE SUPER "66"

. . . for plastic application

● "Springy ball" structure assures high coverage (dry coverage is 50-55 sq. ft. per 100 lbs.) and minimum shrinkage. Efficient for temperatures as high as 1800° F. Does not cause corrosion. Reclaimable up to 1200° F. Packed in 50-lb. bags.

EAGLE SUPERTEMP BLOCKS

All-Purpose . . . Lightweight

● Withstand elevated temperatures up to 1700° F. Water repellent. Resist all normal vibration and abrasion. Easily cut and sufficiently soft to fit over rivet heads and irregularly-shaped surfaces. In all standard sizes.

EAGLE INSULSEAL

Fireproof protective coating

● Recommended as protective coating for Eagle Super "66", Supertemp Blocks, Blankets, other kinds of heat insulation. Provides a permanent seal that safeguards insulation against air infiltration, moisture, water, fumes. Will not burn or support combustion.

EAGLE EP PICHER

Eagle Insulating Materials include . . .

EAGLE SUPER "66" CEMENT
EAGLE SUPERTEMP BLOCKS
EAGLE L-T FELTS
EAGLE BLANKETS
EAGLE LOOSE WOOL
EAGLE INSULSEAL
EAGLE INSUL-STIC
EAGLE FINISHING CEMENTS

See Sweet's Catalog for specifications

THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO

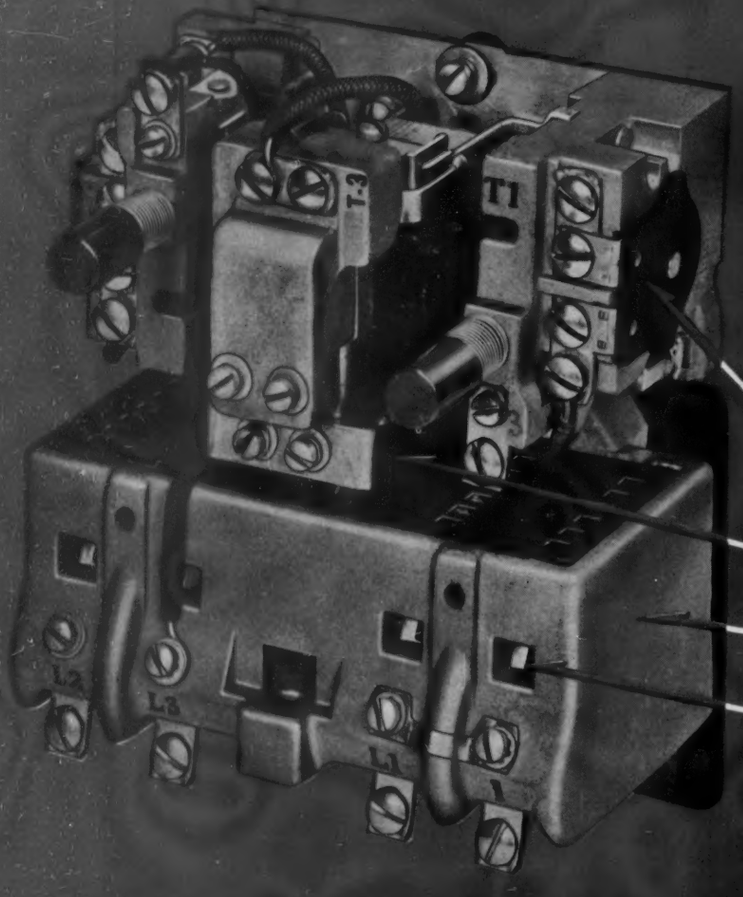
WESTINGHOUSE

"De-ion"

LINESTARTER

DESIGNED FOR EASY INSTALLATION BUILT FOR TOUGH SERVICE

Push-button Operated
—Built-in or mounted separately.



Bi-Metal Overload Protection
hand or automatic reset.

Vertical Operation
prevents accidental closing.

"De-ion" Arc Quencher
prolongs contact life.

Double-break Silver Contacts.

MAGNETIC MOTOR STARTER

CLASS 11-200

Features That Make Installation Quick and Easy

Compact cabinet fits limited space, on machine or separately. Deep-drawn hinged door offers easy access to parts. Ample wiring space. Wiring terminals at front of unit. Concentric knock-outs on top, bottom, both sides. Single screw locks starter in place.

Features That Reduce Maintenance Costs

"De-ion" quenchers prolong contact life by rapid arc extinction—½ cycle. Bi-metal provides accurate, unvarying overload protection. Direct-acting vertical operation—no bearings. Contacts can be inspected without dismantling. Front and back stationary contacts interchangeable. All parts removable from front with screw driver. Non-carbonizing, moisture-resisting arc box.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
EAST PITTSBURGH, PA.

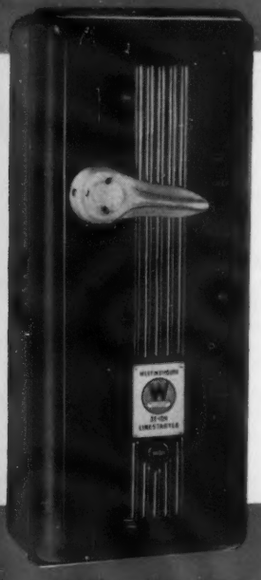
J-21138

Westinghouse

FOR PRODUCTION INSURANCE

buy Westinghouse

TIME SAVERS FOR INDUSTRY



WESTINGHOUSE COMBINATION LINESTARTER

For Motor Control and Circuit Protection

CLASS 11-206

Magnetic motor starter—motor-circuit switch—motor overload protection—nofuze circuit protection—all in one unit. Bi-metal gives permanently accurate overload protection. "De-ion" quenchers protect contacts—save maintenance. Four-in-one Unit saves installation time—saves space—saves wiring—provides greater protection for operators.

WESTINGHOUSE "DE-ION" MOTOR WATCHMAN

Manual Across-the-line Starter for Motors up to 7½ hp.

CLASS 10-100

Quick-make, quick-break toggle action prevents "teasing" contacts. "On," "Off," "Tripped" positions self-indicating. Bi-metal disc overload protection. "De-ion" protection for contacts. Ample wiring space. Rust-resisting parts. Silver contacts. Key-hole mounting for quick, easy installation.

WESTINGHOUSE SAFETY SWITCH

For Circuit Protection

Diamond-pointed break jaw and extended-blade construction prevent burning and beading of contacts. One-piece copper construction saves money by preventing power loss. Quick-make, quick-break on Types A and C. Ample space for wiring. Solderless lugs. "De-ion" arc quenchers on 575-V switches.

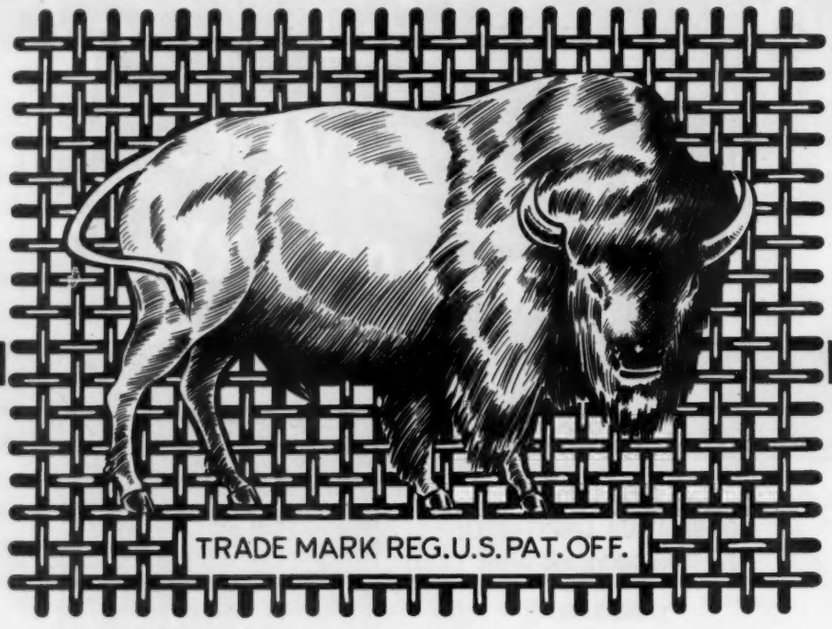
WESTINGHOUSE AB-I BREAKER

For Circuit Protection

Eliminates switch and fuses. Bi-metal overload protection. "De-ion" protection for contacts. Saves maintenance time and production time—circuit outages can be restored by operator. No live parts exposed. Door opens only when switch is in "Off" position. Occupies approximately 40% less space than switch and fuses.

Motors and Control

industrial wire cloth



PRODUCTS

Wire cloth or screening for screening and filtering purposes; wire lath; wire gates, partitions, enclosures; signs, storage bins, switchboard enclosures; skylight guards, machine guards; annealing, dipping and conveying baskets, and many wire devices for industrial and residential building uses.

INDUSTRIAL WIRE CLOTH

In steel, galvanized, brass, copper, bronze, monel metal, stainless steel and many special alloys including special abrasive resistant "Buffaloy". We supply wire cloth either in rolls, cut pieces or special sections to fit any type of screening machinery whether in the sizing of stone, slag, phosphate, lime, cement, coal or any other material. We can supply you a mesh which will give more efficient and economical performance.

WIRE ENCLOSURES

A diamond mesh wire fabric with channel iron frame: this is our formula for making "Buffalo" wire enclosures. Constructed in this way, the enclosure will not hamper lighting or ventilation. These partitions are used for tool or stock room enclosures or for room partitions, floor divisions, etc.

WIRE STORAGE BINS

"Buffalo" wire storage bins are strongly made of a heavy grade of a diamond mesh wire fabric and channel iron frames. Bins are furnished singly or in batteries. They may be used in the delivery department of large industrial plants, department stores, laundries, post offices, or where packages are kept segregated.

WIRE MACHINE GUARDS

"Buffalo" wire machine guards are guaranteed absolutely safe and meet all law and insurance requirements for machine protection. Inquiries for information and prices should be accompanied by blue prints or drawings of the machine to be protected. This practice facilitates handling your order, or inquiries.

STEEL FOLDING GATES

There is practically no end to the uses of "Buffalo" steel folding gates. They are manufactured from flat and channel iron, and are extensively used in residences, office buildings, banks and numberless institutions. Some of these uses include industrial entrances, driveways, elevator guards, trucks, etc.

SWITCHBOARD ENCLOSURES

Furnished in either flat or ribbon wire mesh fabric, these enclosures are fastened to the floor and brick walls by means of expansion bolts and prevent persons from coming in contact or tampering with switches and other dangerous electrical apparatus. It also protects the switchboard itself.

SKYLIGHT GUARDS

We can make these of any size mesh or wire desired. "Buffalo" skylight guards protect glass skylights from being broken by falling objects. They also prevent flaming embers from a severe adjacent fire from falling on and bursting through the skylight, setting a new fire within. Guards are made to measure.

ANNEALING, DIPPING, CONVEYING WIRE BASKETS

Used for various purposes in foundries for pickling castings, in plating works, and for annealing purposes. Baskets are made of plain steel, brass or copper wire, and steel wire galvanized after the basket has been made. We make many baskets for special orders, of monel metal, nickel chromium and other alloys.

FOUNDRY RIDDLES

Made from the finest New England elm wooden rims furnished with either steel, galvanized, brass or tinned wire cloth of our own manufacture. These heavy duty riddles are designed to withstand severe abuse. They are full gauge and full size to give the maximum efficiency at the least cost.

ENGINEERING SERVICE

"Buffalo" wire engineers will help you solve any problem for the installation and use of the products mentioned. We also operate our own galvanizing plant and do job work of the highest quality. Complete catalog No. 11-S and price list will be sent on request.

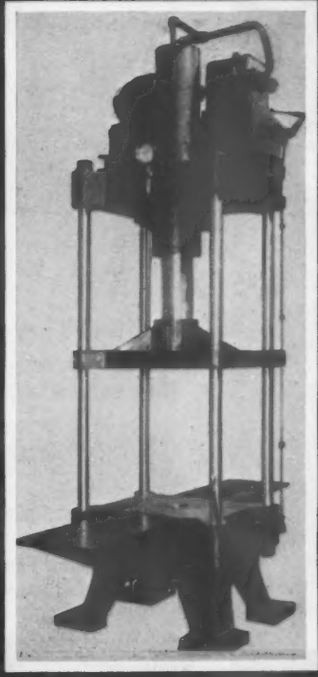
BUFFALO WIRE WORKS CO. INC., BUFFALO N.Y.

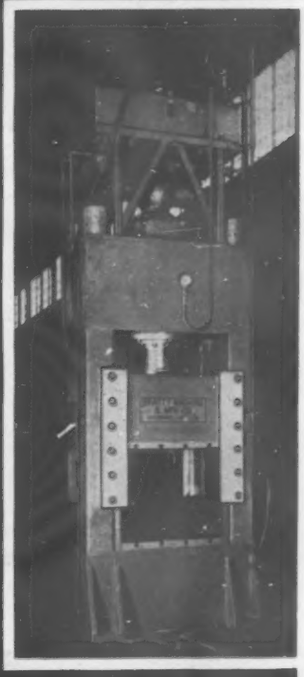
Address Communications to 437 Terrace, Buffalo N.Y.

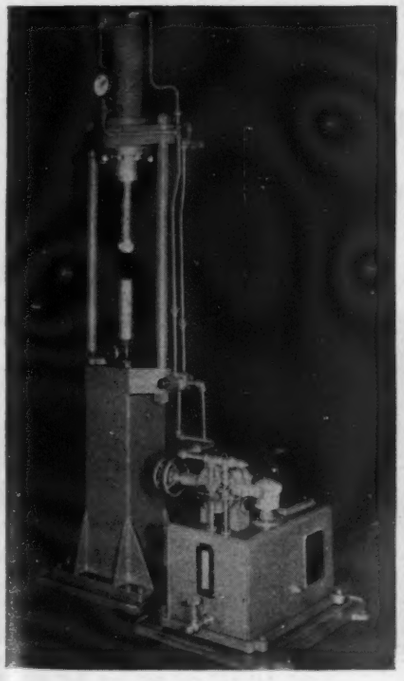
BEATTY *Motor Driven Hydraulic Forcing Presses & Extrusion Presses*

Illustrated at the left is a highly improved Extruding Press for use by welding-rod manufacturers in coating welding electrodes. This rigid and compact press frame requires minimum floor space and gives greater accessibility for operators, resulting in higher efficiency and less lost operating time in production. The Press is designed to give a working pressure of 10,000 P.S.I. on the coating material. Pressure and operating speed changes are effected by quick manual adjustment within operator's reach. Bulletin No. 100 H.E.P. giving further data on this and other types of motor driven Extrusion Presses will be furnished on request.

Beatty Forcing Presses find general use in machine, electric and railroad shops and steel and malleable iron foundries as either maintenance or production machines where all types of bending, forming or pressing is required, such as arbor or bushing work. Immediately to the right is pictured a double acting cylinder hydraulic Forcing Press with 100 tons capacity for all types of general work. At the extreme right is a heavy duty, high speed, four-column, self-contained hydraulic Press of 750 tons capacity for heavy straightening, forming and pressing requirements. These Presses have only one foot or hand control lever for forward, reverse and speed control.







Illustrated at the left is a double acting cylinder hydraulic Forcing Press of 15 tons capacity for use in general shop and laboratory work. Bulletin No. 200 Ed. 2 giving further data on these Presses will be sent upon request.

Standardize on

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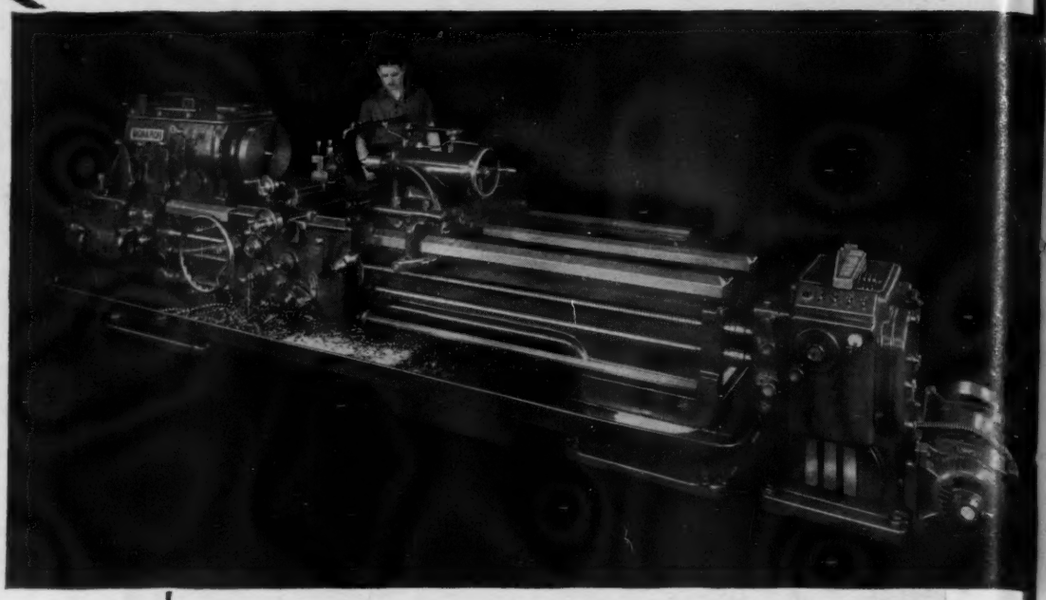
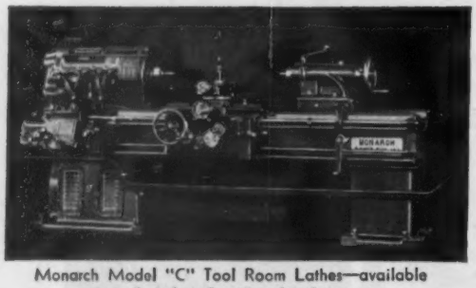
BEATTY MACHINE & MANUFACTURING CO., HAMMOND, IND.



Monarch AUTOMATIC STEEL makes an automatic machine out of any size engine or tool room lathe.

MONARCH LATHES

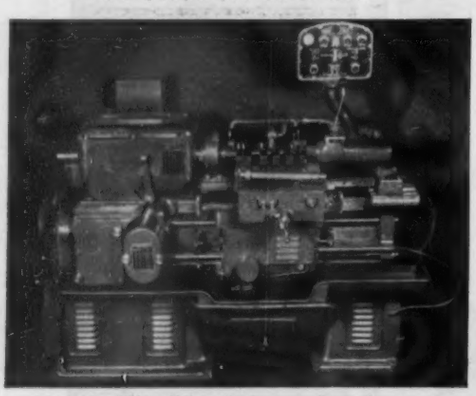
COVER THE TURNING FIELD



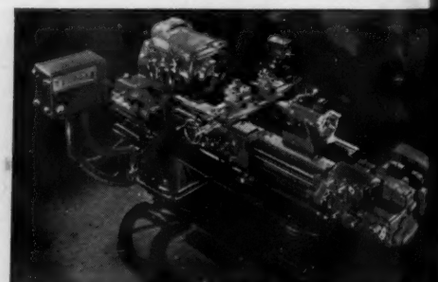
Monarch Model "C" Tool Room Lathes—available in 12", 14", 16", 18" and 20" sizes.

MORE and more, one name comes quickly to mind when you think of lathes—the last word in lathes—MONARCH. It is the symbol of progress, of technical advancement, of forward thinking. If a job is to be turned, it is likely that one of the many sizes and types of Monarch lathes will do the job better, faster, and at lower cost per piece. Monarch engineers can bring to your turning problems a wealth of experience gained during 31 years of broadening the scope of lathe production. The Monarch Machine Tool Company, Sidney, Ohio, U.S.A.

"Expansion Time" Lathes By Monarch Will Do Tomorrow's Competitive Job.

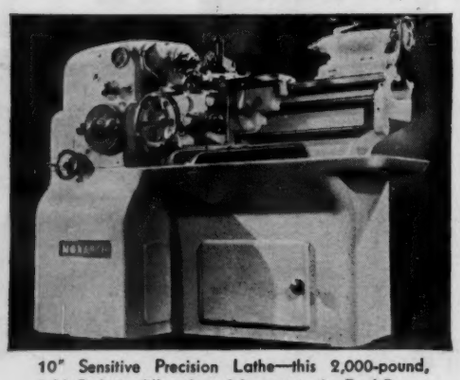


Monarch Hydro-Matic Lathe — performs functions of many machines—is today's most universal automatic lathe.

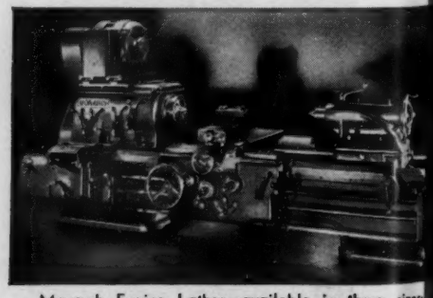


Monarch-Keller—For form turning, boring and facing. Incorporates many advancements which make it the most universal machine ever engineered.

Monarch 5-T Manufacturing Lathe—handles a variety of manufacturing jobs or a single quantity production job.



10" Sensitive Precision Lathe—this 2,000-pound, 3 H. P. lathe fills a long-felt want in the Tool Room.



Monarch Engine Lathes—available in these sizes: 12", 14", 16", 18", 20", 22", 24", 27", 30" and 36".

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STEEL

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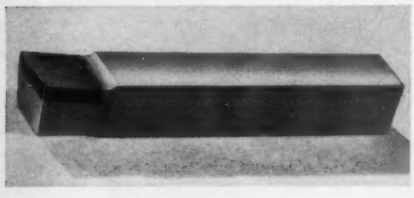
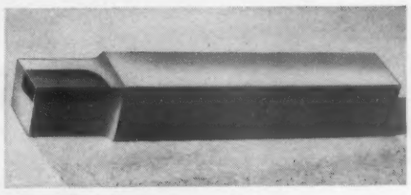


Style No. 1—Standard Tool for steel, cast iron, etc. Available in 9 Sizes

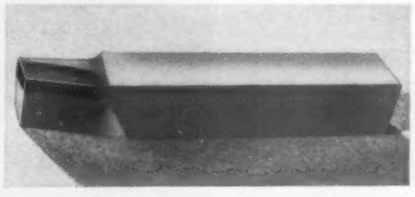


Style No. 4—Standard Tool for steel, cast iron, etc. Available in 9 sizes—left and right hand

In addition to the obvious economy possible these new standard tools offer the advantages of simplified ordering and elimination of the necessity for large, diversified tool stocks covering many grades and styles.

With each tool is packed a condensed pocket size instruction booklet giving feeds, speeds, chip-breaker data and grinding instructions.

Catalog GT-125 for prices and specifications.



Style No. 13—Standard Tool for steel, cast iron, etc. Available in 5 sizes, left and right hand

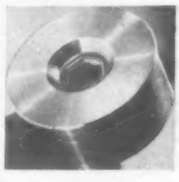
Standard Dies for Drawing Round Wire, Bar Tubing

Carboloy standard round hole dies for drawing wire bar and tubing are available in nibs R-1 to R-18 inclusive for sizes up to 3½" in diameter. Used for drawing low and high carbon steel and non-ferrous metals. Supplied in finished form ready for use or in cored form (semi-finished) for final finishing in your own die room. Catalog D-106. Complete die room equipment available for finishing and servicing work in your mill. Catalog D-103.

Carboloy standard round hole dies produce closer tolerances and a higher quality finish, two factors that not only provide economies on the original work but also result in substantial savings on subsequent processing operations such as machining, threading, etc., on the wire, bar and tubing.

In addition to this standard line, numerous special dies are available for sheet metal drawing and redrawing, bolt sizing, etc.

Standard Dies for Drawing Square and Hex Shapes



Carboloy standard dies for drawing square and hexagonal shapes are available in sizes up to 2" across flats, hexagonal, and 1⅝" across flats square. Catalog D-107.

Until recently supplied only in finished form ready for use, these dies now are available in cored form (semi-finished) for rapid finishing to desired size in your own die room. Standard equipment for finishing and service work available. Catalog D-108.

Carboloy shape dies finish the material within close limits, with controlled corners, and frequently eliminate grinding and polishing operations.

In addition to the standard square and hex dies, any special shapes can be supplied.

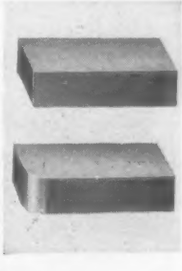
Carboloy Masonry Drills For Drilling Concrete, etc. 50% Faster

With new plants, plant expansions and alterations being rushed, Carboloy Masonry Drill-Points have become unusually valuable time savers. They drill holes in concrete, tile, porcelain, brick, slate, etc., 50%-75% faster than ordinary drills, or slow, hand chiseling methods. Provide unusual economy in the installation of new equipment, partitions, service lines, plumbing, etc. Drill clean, accurate holes, won't splinter fragile work and are quieter for occupied office work. Available in complete size range. Leaflet GT-103.

Carboloy Diamond Dressers For All Types Grinding Wheels

Available in standard sizes ¼", $\frac{1}{16}$" and ⅜" diameter, Carboloy diamond dressers are stocked for immediate delivery in 5 commonly used holders and also in completed matrix form requiring mounting only in holder specified on your order. These dressers, containing a multitude of diamonds impregnated in a hard Carboloy matrix, require no remounting, stand unusual abuse, eliminate diamond loss and waste and are uniformly priced at $9.60, $12.60 and $15.35, including holder. Catalog DR-38.

Standard Carboloy Blanks In 2 Styles and 3 Grades



Standard Carboloy Blanks for mounting on your own shanks are stocked for prompt delivery in a wide range of sizes in the two styles illustrated. Especially low priced . . . for example, a blank for a $\frac{1}{16}$" square tool bit costs 56c in lots of 1 and 22c in lots of 50 or more. Standard blanks are available in Grade 78-B for universal use on steel cutting and Grades 44-A and 883 for use on cast iron, brass, aluminum, non-metallics, etc. Catalog GT-126. Instructions provided for brazing blanks to your steel shanks.

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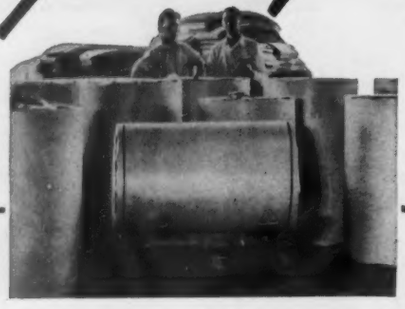
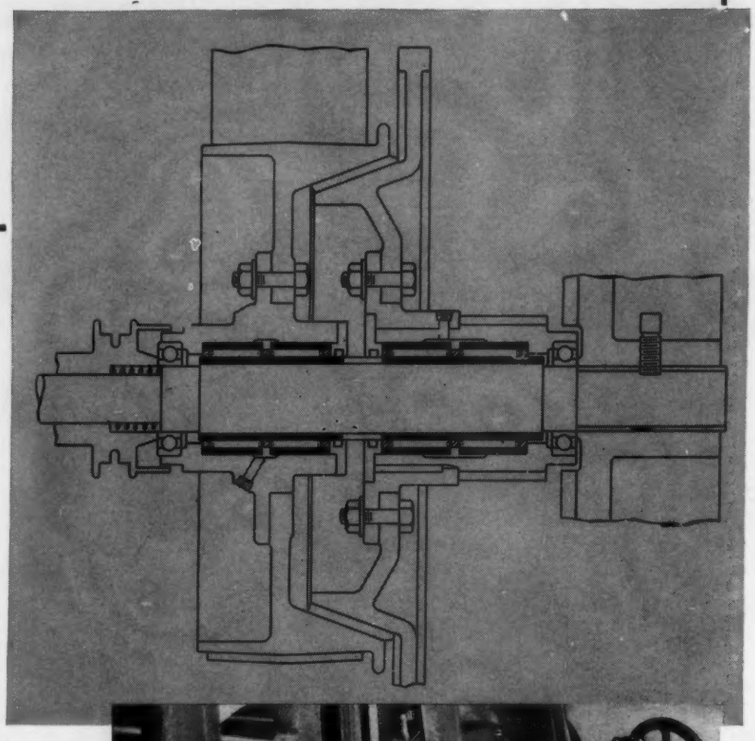
For Faster PRODUCTION





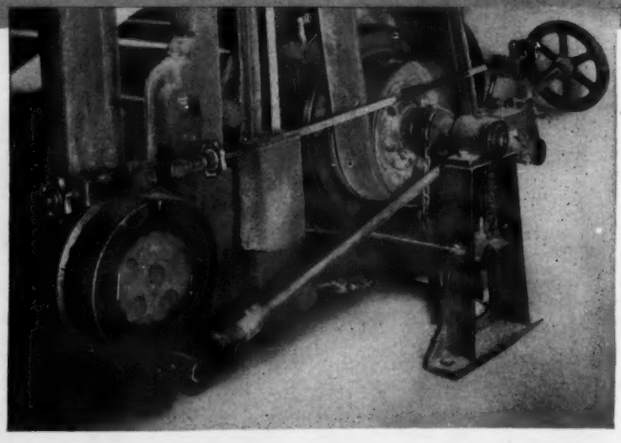
MISSISQUOI REWINDER SPEEDED UP, FRICTION PULLEY TROUBLES BANISHED WITH SPECIAL BANTAM BEARINGS

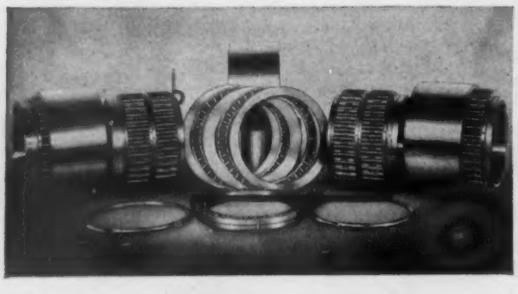
Demands for faster and faster speeds—and the elimination of costly shut-downs and outage time were two problems solved for the Missisquoi Corporation by special Bantam Radial Roller Bearings.

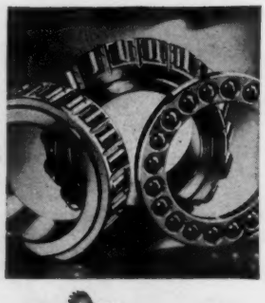
Let Mr. G. L. Johnston, Missisquoi's Plant Engineer, tell you the details. "These Bantam Bearings were installed in March, 1938, replacing bronze bushings, on the main friction pulley shaft of a rewinder. Since this machine was originally installed it has been necessary to operate it at considerably above its original speed and we had been constantly replacing these bushings—to say nothing of the headache of a shut-down at some of the most inopportune times. However, since these Bantam Roller Bearings had been installed this machine has never been shut down for Friction Pulley trouble, for which we are very thankful."

Here is another example of the way Bantam's background of experience in the design and manufacture of all types of anti-friction bearings can help you in securing top-notch bearing performance. Bantam Engineers will be glad to cooperate with you and with your machine builders in the selection of the right bearings for *your* requirements. For dependable, trouble-free bearing service—TURN TO BANTAM.

BANTAM BEARINGS CORPORATION, South Bend, Indiana







(*Far Left*) **BANTAM'S RADIAL ROLLER BEARINGS** of the same general type used in the Missisquoi rewinder installation find many applications in paper-making machinery where loads and speeds are high, and service demands are severe.

(*Left*) **BANTAM MAKES ALL MAJOR TYPES** of anti-friction bearings from tapered roller, straight roller and ball bearings in giant sizes—to the smallest of Quill Bearings. This wide experience enables Bantam to give expert, unbiased counsel in the selection of the correct bearing for any individual job.

BANTAM BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

STEEL
PRODUCTION • PROCESSING • DISTRIBUTION • USE

HIGHLIGHTING THIS ISSUE

■ FOR THE first time in many years there is complete harmony among forecasters: 1941 is seen as a year of plenty. It is to be a year (p. 197) of great industrial and business activity—a year of opportunities. . . . On the other hand it will be a year requiring extreme vigilance on the part of industrial management —for policies conceived and executed during the coming year will have a profound effect in shaping future good or ill. As the year starts manufacturers find themselves sorely perplexed because so many questions of great importance remain unanswered. Anxious to serve the country to the limit of their ability, the great majority of them do not know what they are expected to do.

♦ ♦ ♦

How Much Expansion?

Whether or not they should expand their manufacturing capacity is, perhaps, the most important unanswered question confronting many industrialists at this time. Defense needs conceivably could involve all of industry. Every plant has equipment that could be used in manufacturing one or more items essential to modern military preparedness. There is the question as to the extent to which production of peacetime goods may be reduced to clear the way for more intensive armament manufacture. Complicating this question is the firm belief in certain influential government circles that the defense program must not interfere with the standard of living; rather, it should elevate it.

♦ ♦ ♦

Ingot Capacity Sufficient

In certain industries there have been and will continue to be notable expansion. This is true in connection with aircraft (p. 378), shipbuilding (p. 384), machine tools (p. 199 and certain other equipment. Capacity for producing zinc and copper (p. 394) is to be increased. In many other fields the question of expansion has not been definitely answered. Take, for example, the controversy in steel. Government economists hold that a 20 per cent expansion in steelmaking facilities is needed. Steel's leaders, on the other hand, after analyzing all possible requirements, declare (p. 374) that existing practical ingot capacity of 83,000,000 net tons is sufficient.

♦ ♦ ♦

Labor Unions Plan Drive

One of the question marks on going into 1941 is in connection with labor. There is no doubt whatever (p. 209) that the whole labor situation is unhealthy. More and more thousands of workers must pay union initiation fees and membership dues before they can get jobs. A more intensive drive for unionization of all open shops (p. 184) is seen ahead—and it is expected to have Washington's blessing. At the same time, much comfort is to be derived from the appointment of Dr. Harry A. Millis as successor to J. Warren Madden as chairman of the national labor relations board. As a result a much more moderate and just administration of the labor law is foreseen.

♦ ♦ ♦

Upward Price Spiral Avoided

One of the outstanding phenomena during 1940 (p. 316) was that prices, despite difficulties in obtaining many products as quickly as wanted, were held in check. This resulted from two factors. Business men, recalling the consequences of the upward spirals of the World war period, were desirous of avoiding or minimizing a repetition of that previous experience. Too, government representatives, desirous of preventing inflation and its effects on the standard of living, watched prices carefully and were quick to challenge and investigate such advances as were made. Advances on ferroalloys and alloy ores, on pig iron, coke and scrap all came under government scrutiny. No objection was offered when it was shown that they were

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Fast delivery is assured from ten conveniently located Ryerson plants . . . no order too small for prompt, personal attention or too large for immediate shipment.

RYERSON CERTIFIED STEELS

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based on higher costs. Because of a continuation of this attitude prices are expected to be fairly stable in 1941, with advances here and there as made necessary by higher wages or other costs. In Washington the emphasis is being laid more and more on production; the tendency is to become worried only when there is a scarcity of needed goods. If higher prices are necessary to get required production, they will not be opposed.

♦ ♦ ♦

British Steel Prices Higher

The feeling at Washington is that the British experience with prices and wages, under a policy of complete government control, can be regarded as indicative of what, to some extent, we may expect here. British pig iron prices (p. 311) have advanced by 18 per cent, billets by 22.5 per cent and finished steel products by 35 to 40 per cent. These advances resulted from higher wages, higher transportation charges and other cost advances. They also resulted from a policy of benefitting a central fund which the British set up and maintain for the purpose of buying steel from abroad. British steelworkers' wage rates have been advanced rather sharply since the war started; living costs also have increased. Wage rates are rather closely geared to the cost of living, a system which appears to be working satisfactorily for all concerned.

♦ ♦ ♦

Advances in Technology

Comments from 156 authorities in the metal producing and metal consuming industries (pp. 219-286) reveal the vast strides in technology that characterized the year just completed. For example, a new press for aircraft forming work can employ 24 men continuously to load and unload it, six die slides being synchronized to work automatically with the ram. . . Better refractories are permitting longer furnace campaigns, with greater outputs. . . . Nondestructive examination by gamma rays, X-rays or radium help to produce sounder castings. . . Drop forging method now is being used to make many additional armament items. . . . Advances in nonferrous metals aid the munitions program. . . Better controls allow greater efficiency in many processes. . . . Welded aircraft joints now approach tensile strengths of 200,000 pounds per square inch. . . Steel armor plate is being cast satisfactorily. . . Great progress has been made in machining. . . A heat treater increased output by 400 per cent through improved materials handling alone. . . Here are some things we must do to speed defense: Use key equipment such as machine tools and forging hammers 24 hours a day; train more workers quickly; expand automatic processing—recently extended to riveting and heat treating—to other types of operations; standardize on a few significant steels to simplify steel production and procurement problems.

♦ ♦ ♦

Tax System To Be Overhauled

The attitude of government toward business appears to have improved during the past year. It has become evident (p. 184) that the defense billions will not be used to destroy the private enterprise system. L. M. Lamm, STEEL'S Washington editor, believes that the President (p. 200) will not consider any major changes affecting industry but, rather, will make an effort to "consolidate" New Deal social gains. He reports the President favors saving money by filing away further nonmilitary public works projects for use in taking up any work-lag at the end of defense spending. . . Congress is expected not only to raise taxes but also to overhaul the whole tax system. Necessity for a complete revision of the tax structure long has been recommended by business leaders. Obviously it is a problem requiring much careful study.

♦ ♦ ♦

New Deal Is Here To Stay

Congress also is expected to reflect greater consciousness of its responsibilities and its prerogatives. Industrialists, however, are not warranted in expecting any real encroachments on New Deal policies. The New Deal is here to stay during all of 1941. One manifestation is seen in the growing tendency of the courts to support New Deal policies. The President, in the past eight years, has appointed 5 of the 9 Supreme Court justices, 79 of the 161 district federal judges and 36 of the 56 judges of the circuit courts of appeals. He will continue to hold the appointive power over the next four years.

Business in a Changing

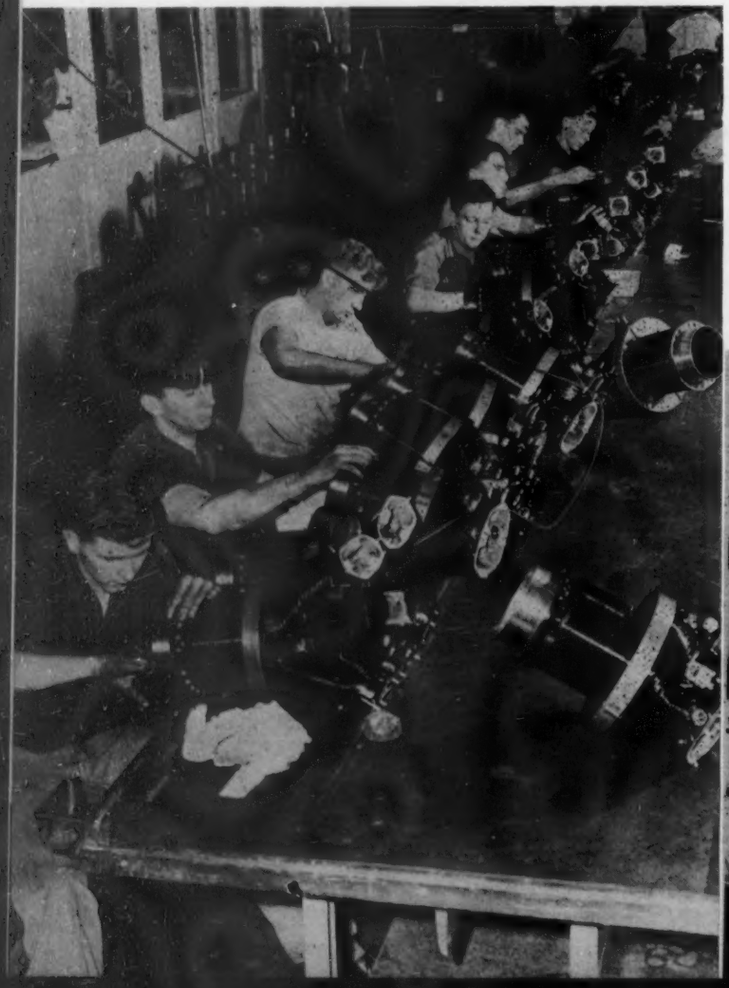
By B. K. Price

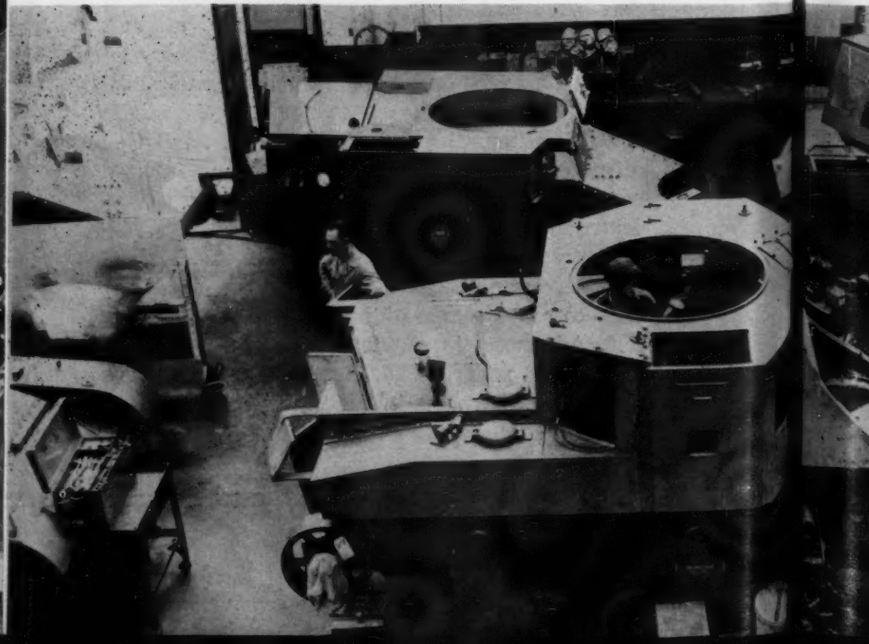
Associate Editor, STEEL

■ WHATEVER the uncertainties ahead, one certainty is that the steel and metalworking industries will have a new all-time record of activity in 1941. So closely allied have become the interests of this country and Great Britain that only establishment of peace abroad on British terms could materially alter the outlook. This, admittedly, is not in prospect for 1941. Hence the likelihood of a period of increasingly intensified rearmament, with still greater aid in materials for Great Britain, and all that it means in the way of still greater requirements of steel, metals and equipment. All this will be on top of a war-stimulated domestic commercial demand.

The country entered the new year with approximately 17 billion dollars authorized for defense and still further huge sums in prospect; and of the amount approved so far practically all has been newly cleared on specific contracts. Actually cash defense expenditures for November of $365,233,578 were greater than the $337,030,000 paid out in all of 1916, prior to this country's participation in the World war; and by next June, the end of the government's current fiscal year, these expenditures will be in excess of $600,000,000 a month, it is estimated.

Effect of this vast spending on the steel and metalworking industries is obvious, particularly considering the requirements of ships, airplanes, ordnance,





■ **Accent is on production as this country struggles to achieve armed might in a hurry. But accuracy cannot be sacrificed for speed, as the workmen (left) honing cylinders for Cyclone aircraft engines in Wright Aeronautical Corp.'s Paterson, N. J., plant well realize**

...World.....

In retrospect, the many important changes that have manifested their appearance upon the national scene almost daily in the past year still seem, even to keen observers, as little short of bewildering. And yet, to function advantageously in a rapidly changing world, a correct understanding as to their nature and significance is essential.

In the accompanying article Mr. Price takes all the things that have happened on the politico-industrial front and fits them together into the pattern that existed on Dec. 27, the date on which the article went to press.

Where we will go from here Mr. Price is unable to reveal. Undoubtedly many further important changes are in store—perhaps for the very near future. Careful perusal of Mr. Price's article should enable STEEL'S readers, through giving them a better understanding of the sweeping changes that already have occurred, better to understand the developments of the future, whether they will relate to taxes, priorities, industrial conscription, the extent of our participation in the war, aid to England, wages, hours and many other factors that now are of great importance or which will become so.

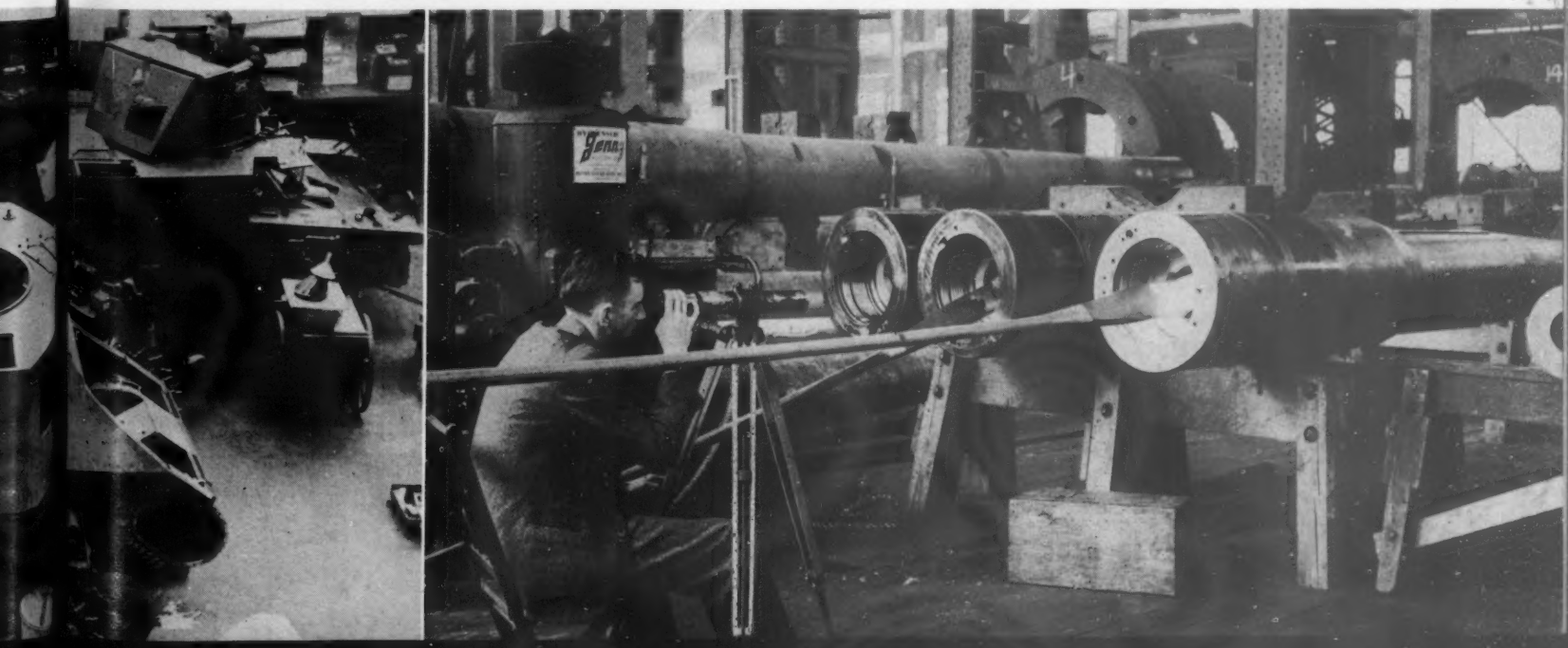
The Editors

ammunition, and various mechanized ground units, which are needed in bringing the country almost from scratch to a position of first ranking military power.

This, of course, is only part of the picture. Large increases in industrial, government shop and shipyard facilities are needed to produce these requirements; military construction projects, such as cantonments, fortifications, navy and airplane bases, supply houses and similar buildings are under way; transportation facilities must be expanded; bridges and large industrial housing developments and numerous other projects must be built.

Then there are the pressing and constantly swelling needs of Great Britain. Since the beginning of the war she has purchased approximately three billion dollars of supplies in this country, paying as she has gone along. Now Great Britain has a program for the purchase of another three billion, and maybe more, before the year is over, but on this she is seeking financial assistance, thus posing an important problem for our government. However, she will undoubtedly get such aid as she requires, on the basis of one plan or another.

Briefly summarized by Defense Commissioner Knudsen recently, the defense program and military equipment orders on hand for Great Britain and certain other countries call for: 50,000 airplanes, 130,000 engines, 17,000 heavy guns, 25,000 light guns, 13,000 trench mortars, 33,000,000 shells loaded, 9200 tanks, 300,000 machine guns and ammunition, 400,000 automatic rifles and ammunition, 1,300,000 regular rifles and ammunition, 380 navy ships, 200 mercantile



■ **Modern production methods are being instituted in United States arsenals. Lower left, view of tank assembly plant at Rock Island, Ill., arsenal. Lower right, inspecting large gun barrels at Washington navy yard. Wide World photos**

ships, 210 camps and cantonments, 40 government factories, clothing and equipment for 1,200,000 men.

It is estimated domestic defense requirements and British and Canadian needs this year will probably take about 15 per cent of the country's steel capacity. But the importance of this in steel lies not in this amount alone, but also in the stimulating effect such business will have indirectly on capital expenditures in a number of industries and on general purchasing power.

An expanding demand for consumer goods appears likely for some time to come as a result of heavy sums being spent for rearmament. Should the international situation later create an acute emergency, this trend eventually might be subject to change as military requirements make increasingly large demands on productive facilities, materials and labor, and as burdens of financing these requirements become heavier, thus resulting in still higher taxes and in more calls on the individual for participation in various forms of war financing. However, judging from current plans of many large consumer goods manufacturers, this seems some distance away.

■ **New draftees in Uncle Sam's army receive instructions at Fort Dix, New Jersey, in use of a 30-calibre machine gun. Thousands of similar units will be manufactured in United States plants during the coming year. NEA photo**

■ IN THE YEAR just ended estimated ingot and steel for castings production of 67,447,325 net tons exceeded the previous all-time high of 1929 by 7 per cent; surpassed the World war record of 1917 by 34 per cent and the 1939 level by 27 per cent.

Machine tool industry operated at by far the highest level in its history and contemplates an expansion in its business of at least 50 per cent this year.

Aircraft industry, the most spectacular of all the so-called defense industries, has as of Nov. 15 increased its capacity 83 per cent since the outbreak of the war in Europe and upon completion of new facilities under construction will have brought this figure up to 265.8 per cent.

However, despite all recent activity, the great peak of defense work lies ahead, perhaps in 1942. Progress to date has been largely along organization and contractual lines; the great bulk of actual production is yet to come; and before this can get under full swing, much construction must be completed.

The national defense advisory commission estimates the defense program will require before the end of 1941 the expenditure of approximately one and one-half billion dollars for plant construction, including that started during the past year.

Of this amount $830,000,000 of construction will be financed privately, $520,000,000 paid for directly by the government and $175,000,000 will be financed by Reconstruction Finance Corp. loans.

Government Aids Plant Construction

No classification breakdown of the privately financed construction has been given, but of the $175,000,000 to be advanced by the RFC, $154,000,000 is earmarked for the airplane industry, and of the $520,000,000 to be advanced by the government, $150,000,000 is for shipways and shipyard equipment; $132,000,000 for airplane and engine plants; $231,000,000 for armor, tank, ammunition loading plants; and $7,000,000 for miscellaneous plant construction.

Of two billion dollars to be spent by the government for all types of defense construction, more than one billion dollars of work has already been contracted for. Incidentally, the $520,000,000 to be spent for plants is the second largest construction item to be financed directly by the government, the largest being $631,000,000 for housing the armed forces.

Third largest item calls for $337,000,000 for new air bases, including hangars, shops, administration buildings and the like; the fourth, $258,000,000, believed to be principally sea-coast defenses and various military posts other than air bases; and the fifth, $240,000,000, for providing 65,000 to 70,000 dwelling units for defense workers and homes for families of enlisted service men.

Thus the rearmament program in many respects is just getting under way; however, wartime influ-

ences have had a marked stimulating effect upon the steel and metalworking industries for many months. Outbreak of the European war a year ago last fall set off one of the heaviest steel buying movements on record and forced steel production in the last quarter of 1939 to the highest level up to that time.

Much of the buying was anticipatory—at first because of the possibility of higher prices, which did not develop, and shortly after because of the very real difficulty in obtaining deliveries. The speculative character of much of this business was reflected in the decline in new bookings after the turn of the year and the easing of ingot operations from above 90 per cent at the end of 1939 to around 60 per cent by the end of the first quarter last year.

Consumption Exceeded Production

Steel fabrication was maintained at a more uniform level, for it was essentially a digesting period. However, the decline in both new orders and steel production was cushioned by increasing demand from abroad. Direct purchases of steel by England and France had not reached anything like the volume later anticipated, but they were expanding and of still greater importance was the business being placed by the Allies for equipment to be fabricated here—machine tools, airplanes, trucks and many other products.

Demand from European neutral countries and South America was gaining.

With German conquest of Norway and the Low Countries, the tempo of steel buying increased. English and French commitments were stepped up sharply, and there was a quickening of defense preparations here.

When France capitulated in June, England took over most of her commitments here. Steel production took a spurt to almost 90 per cent by the end of June, hovered a little under this figure during July and then averaged well above 90 over the remainder of the year, and all notwithstanding a hard-fought Presidential campaign.

In the days following France's collapse, defense preparations really began to move. Within a few short weeks billions of dollars were approved by congress for military and naval defense, and billions more were proposed. The council of national defense was revived, a new fiscal program was launched and various other emergency measures were enacted. Congress had been told by the administration to go home, but it stayed and found plenty to do. Also, the President itemized a long list of military equipment "on order," which was encouraging except for the fact that it was soon revealed that most of it had not gotten beyond the order stage.

By early July the country's potential defense bill had well exceeded 15 billion dollars since the first of the year, with most of it having been made available or authorized since May 16, when the President, with the Germans smashing through Europe, warned congress "of the necessity for the protection of the whole American hemisphere from control, invasion or domination."

Thus the nation, while not engaged in war, settled deeper into a routine of war economy. The further expansion in industrial activity which continued throughout the remainder of the year became dominated primarily by considerations of speedy rearmament and such assistance as could be extended to Great Britain.

This was especially true in the machine tool and airplane industries.

This did not mean the great bulk of steel produced in the last half went into armaments; but an increasing amount did, defense needs getting preference in production and deliveries. It meant also an increase in demand for steel from manufacturers of consumers goods in meeting expanding business for their own products and in building up stocks against the time when many of them would be forced to divert more of their capacity to defense needs. It meant, too, increased commercial buying because of the pos-

■ Inspector checks a portion of an order of 500,000 75-millimeter shell casings ready for shipment to the United States army from the Norris Stamping Co., Los Angeles. Wide World photo

sibility of priorities and the very definite extension of delivery schedules.

The steel industry entered the emergency at the highest point of technological developmnt in its history and with ingot capacity at practically the highest level. Within the preceding five years the industry had expended approximately one billion dollars on expansion and betterments. Nevertheless, the scope and character of the rearmament program, and the urgency of its demands, has forced further expansion. This has been encouraged by Washington, where the doctrine of an economy of scarcity has at last given way to the concept of an economy of abundance. Recently the national resources planning board, set up in 1939, tentatively suggested a large expansion outlay for the steel industry.

Expansion so far has been mostly in processing facilities, such as forging and machining equipment, soaking pits and heat treating apparatus, and involving in some of these installations, plants outside the normal range of the steel industry.

Late in the year several companies announced moderate expansions of open-hearth, blast furnace and coke capacity. Generally these were designed to round out existing capacity in other lines.

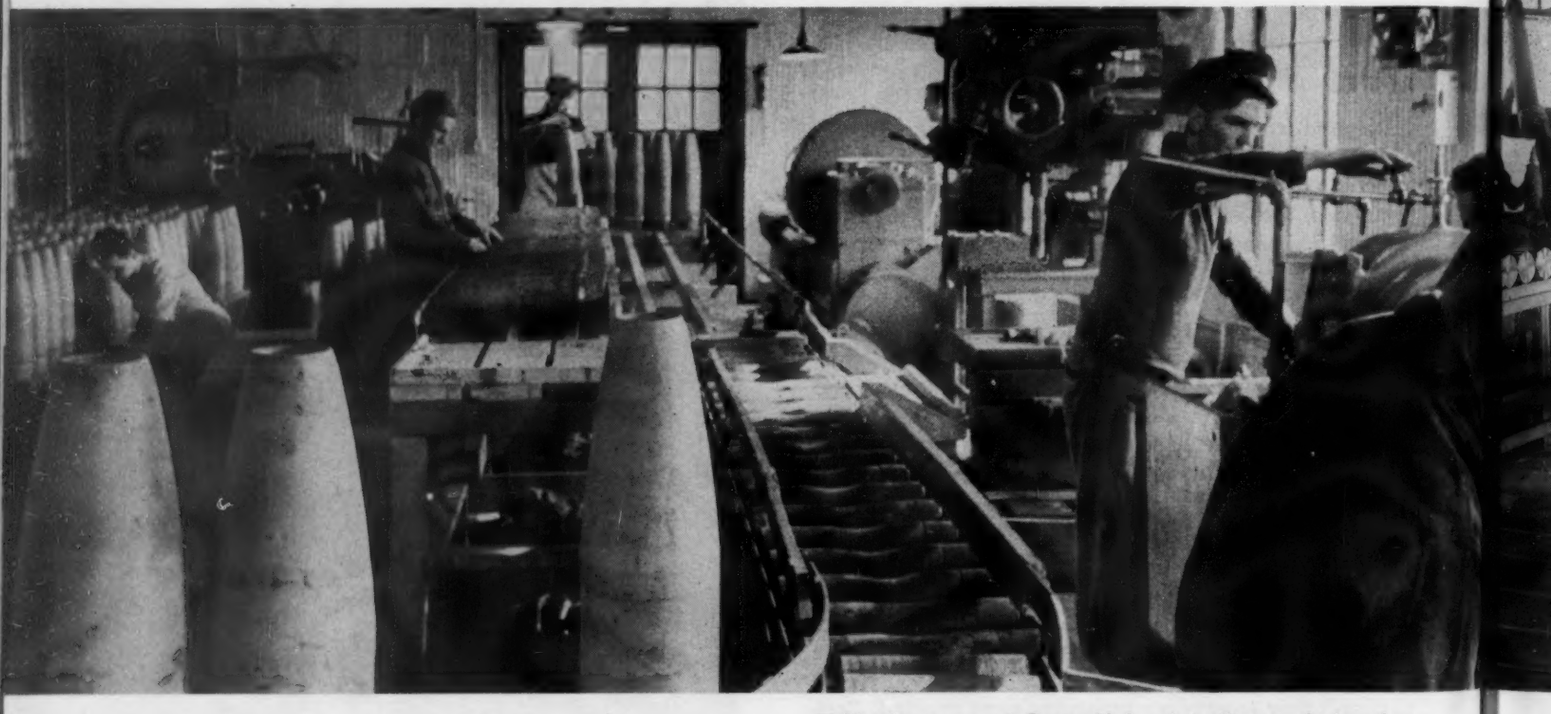
Need for more electric steel furnace facilities also became apparent and it is reliably estimated that with work now under way and approved, capacity will be increased approximately 50 per cent or to more than 2,800,000 net tons.

Two substantial programs announced late last fall —first, 400,000 tons for Tennessee Coal, Iron & Railroad Co., and then 850,000 tons for Bethlehem Steel Co.—will add correspondingly to open-hearth capacity; and, further, it is estimated that more than three quarters of a million tons will be added as a result of lesser expansions and improvements at the plants of various companies. At the beginning of last year ingot capacity was officially estimated as 81,619,496 net tons. By the end of the year this had been increased to approximately 83,000,000 net tons.

Despite Washington opinion to the contrary, most steel leaders believe that, with efficient management, steel capacity does not have to be greatly expanded on the basis of the present outlook. Further, they believe the manner in which the defense program must necessarily unfold will tend to relieve certain pressure. Many new plants are having to be built or at least expanded, and must be equipped before they will be ready for steel for the production of armaments, and by the time they are, much steel capacity now in urgent demand for construction and equipment of various descriptions can be diverted to that purpose.

Incidentally, the problem of equipping many of these plants is serious; builders of machine tools and much other equipment have long since been booked up months ahead.

The spread in navy requirements also is counted upon to relieve pressure on steel production, for here, even apart from heavy expansion of facilities, the nature of the work is such that operations cover a period of many months in most cases.



■ **Picatinny arsenal, Dover, N. J., originally was designed as a storage depot for powder. Projectile sheds, nitrate buildings and a loading plant later were erected, followed by construction and equipment of a powder factory. Above, large caliber shells are being renovated after storage. Right, complete rounds are being loaded and packed. Photos, courtesy, Army Ordnance**

■ TO ENABLE the steel industry to co-operate closely with the government in the handling of defense requirements, Walter S. Tower, president, American

Iron and Steel institute, maintains offices in Washington, where he spends much time.

The institute also has a special committee on government specifications which co-operates with governmental departments and agencies in formulating and interpreting specifications for steel products. E. C. Smith, chief metallurgist, Republic Steel Corp., Cleveland, serves as chairman.

To co-ordinate defense activities, the national defense advisory commission was appointed by the President May 29 under the authority of the army appropriations act of 1916, an organization that resembled in personnel the war industries board of 1917-18, although lacking its powers.

Likewise the council of national defense was technically revived under this act—a body comprising six members of the cabinet. But as was the case during the World war, the council existed largely in theory, with the advisory commission charged with the active co-ordination and answerable only to the President.

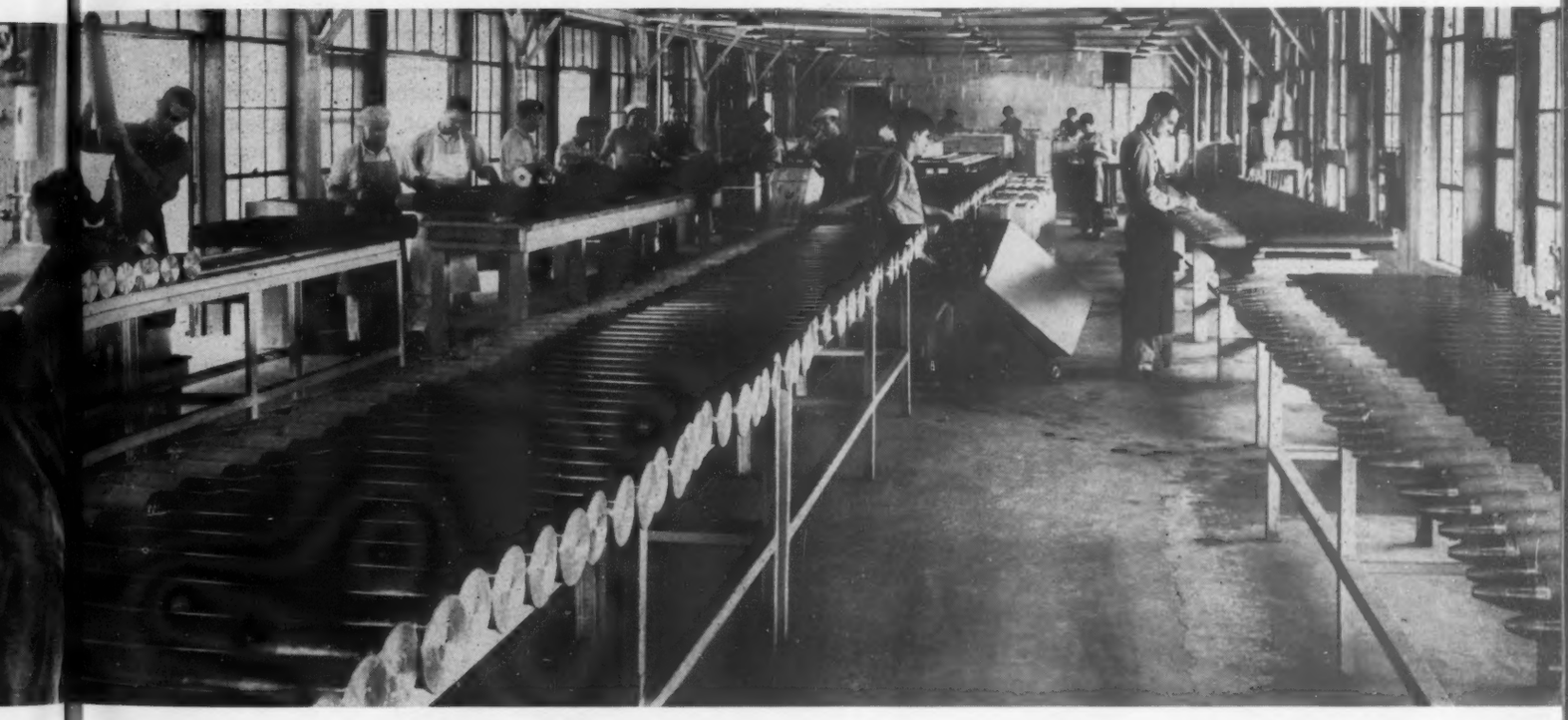
Notwithstanding its accomplishments, the advisory commission labored under a severe handicap from the start. Technically, the President was chairman, but with his time so fully occupied, this worked out poorly for in actual practice the commission was without leadership. Throughout the fall and the Presidential campaign this situation was frequently noted, but it was not until Defense Commissioner Knudsen's speech in New York in the early part of December, in which he pointed to a serious lag in the defense program, with airplane production behind schedule by 30 per cent, that plans for reorganization began to take definite shape, culminating late in that month in the appointment of a superdefense council, comprising four members.

Known officially as the office for production management for defense, this council has Mr. Knudsen as director, Sidney Hillman as associate director, and Secretaries Stimson of the war department and Knox of the navy as members.

Under this council are three subdivisions: (1) Actual production of war munitions; (2) office for defense purchasing; and (3) defense priority board. Donald M. Nelson is head of the office for defense purchasing, with the priorities board composed of Messrs. Knudsen, Hillman and Nelson and Edward R. Stettinius Jr., in charge of raw materials, and Leon Henderson, in charge of prices.

The superdefense council was set up under powers of the first reorganization bill, passed a couple of years ago, with clause 6 authorizing the establishment of an emergency management office in the office of the President.

The advisory defense commission is scheduled to continue because each of the seven members has specific duties to perform. However, in all matters coming before the commission the 4-man council is to have final word and authority, it is said. At the same time, the full scope of the authority delegated to the new council still remains to be appraised.



For the record, those on the advisory committee remain as originally appointed: Mr. Knudsen, in charge of manufacturing and production, and who early resigned as president of the General Motors Corp., to devote his entire time to duties in Washington; Mr. Stettinius, in charge of raw material supply, and who likewise early resigned his business affiliation, as chairman, United States Steel Corp.; Ralph Budd, chairman, Chicago, Burlington & Quincy, in charge of transportation; Sidney Hillman, president, Amalgamated Clothing Workers of America, labor; Chester C. Davis, a governor of the federal reserve district, agriculture; Mr. Henderson, securities and exchange commission, prices; and Miss Harriet Elliot,

dean of women, University of North Carolina, consumer problems.

With certain important modifications, the advisory commission, as originally set up, was fundamentally the same as the war resources administration envisaged under the industrial mobilization plan which was proposed under the national defense act of 1920, and which subsequently has been drawn up and revised many times under the direction of the army and navy munitions boards for use in wartime.

In the event of actual hostilities, this plan called for certain powers which the advisory commission never possessed. For instance, it called for a certain control of prices for raw material and of wages and could, in fact, requisition labor, it is said.

Through the broad emergency controls granted the President by various statutes over recent years and through its own prestige, the advisory commission last year could exert considerable influence where necessary. For instance, the commission itself could not place contracts, as the procurement of military supplies by statute was in the hands of the war and navy departments, but through the power vested in the President as commander-in-chief, it could supervise the placing of contracts and it was to give effect to the advice of the advisory commission in the matter of purchases that the office of co-ordinator of national defense purchases was created last fall by executive order of the President, with Mr. Nelson, Chicago, a former Sears Roebuck executive, appointed to the job.

However, through it all there was a lack of responsibility in the hands of the commission and a lack of direction due to technicality of setup. It was to remedy this situation that the superdefense council, now known as the "Big Four", was created late in December.

■ BROAD powers were provided the President last fall under section 9 of the selective service and training act of 1940, which deals with "conscription of industry." This section closely parallels certain features of the national defense act of 1920 and is different from section 130 of the national defense act of 1916 in only three respects.

Section 9 of the selective service act empowers the President through the war or navy department, to place orders with individual manufacturers "for such product as may be required and which is of the nature and kind usually produced or capable of being produced." Compliance with such orders is obligatory. Refusal to comply constitutes a felony and subjects responsible company heads to possible imprisonment for not more than three years and a fine up to $50,000. Further, when such refusal is made, the President is authorized, through the war or navy department, to take immediate possession of property and manufac-

■ Sixteen-inch gun department at Watervliet, N. Y., arsenal. Workmen are lifting the mold for the huge gun into a shrink pit. Wide World photo

■ Training for defense jobs. Even the boss, inspired by the boys' enthusiasm, takes off his coat and digs into a knotty problem in the apprentice department at a leading motor manufacturing plant

ture the products or materials which are required.

In the event a plant is taken over, title does not vest in the government. Compensation is to be paid owners for products or materials, or as rent for use of facilities, the amount of the payment to be "fair and just" and to be fixed by the government.

The section differs from the provision of the defense act of 1916 in that: (1) The earlier statute could be utilized only during actual war or during a period in which war was declared to be imminent by Presidential proclamation; (2) the authority conferred in the 1916 act applied only to the war department; and (3) the present act contains a provision to the effect that state or federal laws concerning health, safety, security and employment standards of employes shall not be rendered inapplicable because the plant where they are employed may be taken over by the government or may be compelled to manufacture materials or supplies under compulsory order.

Congress More Conscious of Responsibilities

In a law passed June 28, last year, to facilitate procurement of navy supplies, the President also was given power, through the secretary of navy, to seize any plant the secretary deemed necessary for defense, which could not be obtained for use or operation through agreement with the owner.

While Washington officials contemplate no need for invoking such powers and the federal legislative bodies have shown every disposition to grant the administration those required in the present state of "limited emergency," congress, nevertheless, has been increasingly conscious of its own responsibilities.

On many of these powers, expiration dates have been set, which only congress itself can extend; moreover, despite urgings of administration leaders at one time or another during the past summer and fall for congressional adjournment, congress continued in session, even after the election (although more or less nominally so some of the time).

Growing consciousness of congress with respect to its responsibilities; and, in fact, to the importance of its regaining many lost prerogatives, as well as holding those it has, was reflected until near the end of the year in its attitude on the Walter-Logan bill. This bill was created to provide uniform standards of procedure for various quasi-judicial government agencies.

Business particularly wanted this bill and the Smith amendments to the Wagner act enacted. The Walter-Logan bill passed the house last spring by an even greater majority (282 to 97) than the Smith amendments, which came up for action a few weeks later. Then as was true of the latter it ran into difficulty when administration leaders got hold of it in the senate, but unlike the Smith amendments the Walter-Logan bill was actually passed by the senate late in the year, although in the end the house could not muster the two-thirds majority necessary to override the President's veto.

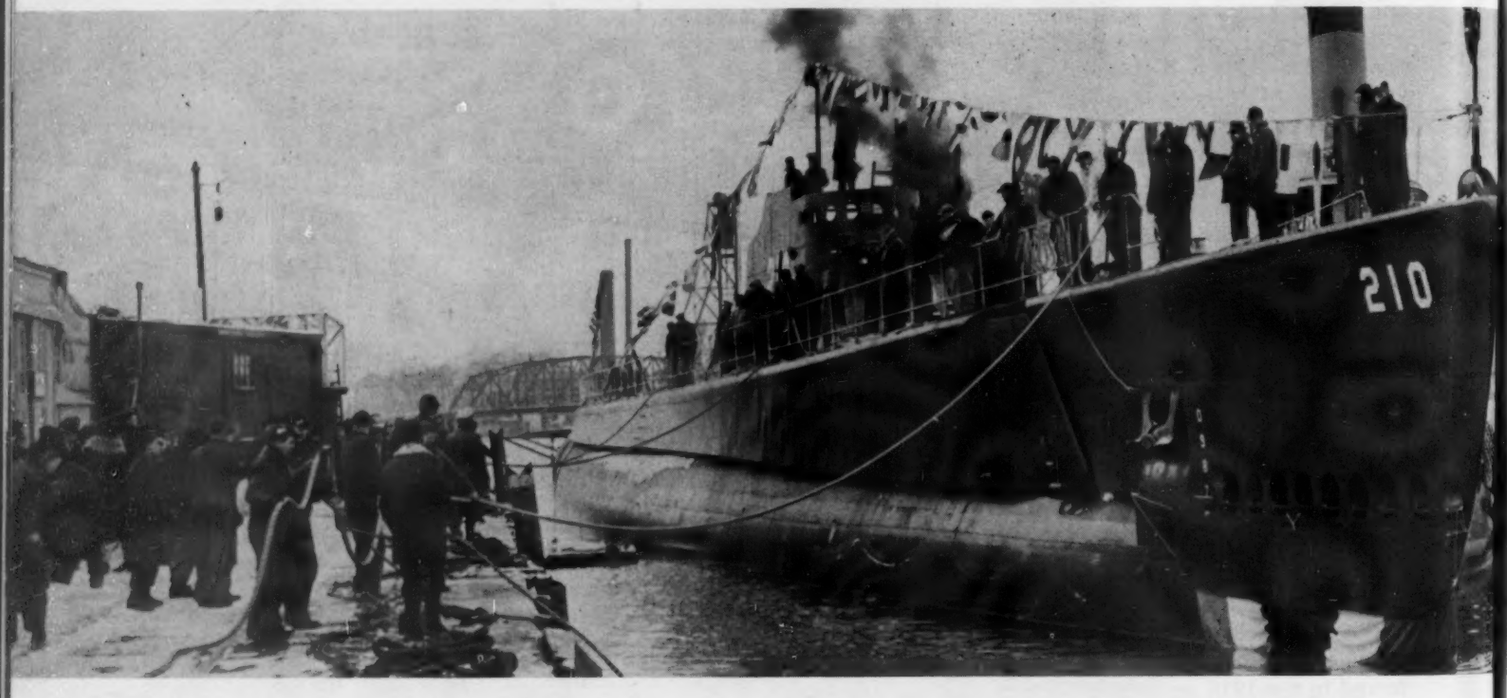
Throughout the summer and into the fall the problem of financing the deluge of defense contracts which

descended upon them was a matter of primary concern to manufacturers. With the steel industry this was particularly true where new facilities had to be added which clearly would serve little purpose after the emergency.

Management in all lines of industry hesitated naturally in spending large sums of stockholders' money for facilities which later would not be required and which would only prove to be an expensive item of overhead. Nor was the government itself inclined to impose any such burden.

Drastic limitations on "war profits," a fixed policy with the government, would discourage private capital; on the other hand, direct government financing was not the whole solution, in view of the large sums of idle private capital in the banks, if for no other reason.

Hence, an effective plan of amortization was the first and most important phase of the problem, and



for several months congress wrestled with the question, insisting upon linking it up with the new excess profits tax bill which was going through the legislature, while valuable time was being lost and the defense program stymied.

Finally Oct. 9, the excess profits tax bill became law, and the amortization clause provided in general for a 5-year write-off on plant facilities acquired or built after June 10, 1940, for government-certified defense purposes. Both buildings and equipment were subject to tax allowances, and a provision was included which permitted an acceleration should the emergency end before the 5-year period.

The amortization clause proved generally satisfactory to business, which previously had been given a scare by provisions appearing in the house version of the bill, giving the government a power of veto over the use or disposal of such properties as were to be financed under the bill. Such power would have permitted virtual confiscation, it was pointed out; but the objectional features were removed.

Another provision of the tax law covered government purchase of privately financed facilities. In this case the government pays off the facilities usually in five equal annual installments; however, the manufacturer has the option at the end of the 5-year payment period (which can be made shorter under certain conditions) of purchasing the property back at cost less normal depreciation, or at a fair price as determined by arbitration.

If the manufacturer does not care to buy, he will be permitted to lease the plant, and if he does not care to either purchase or lease, the government may use the plant for any purpose, even if it means direct competition with the manufacturer.

Still another plan was based on the permanent government ownership of the property, with the government not only paying for the plant, but also the cost of operation. The manufacturer under this plan, receives a fixed fee for supervising the building and equipping the plant and its subsequent operation.

A combination of these methods may be used, with the buildings to be financed under either one of the first two plans and the machinery installed under the latter. In all cases additional facilities must have been acquired after June 10, 1940, and the certificates, which have to be acquired except in the case where the property is permanently owned by the government, must be issued before Feb. 4, 1941, or within 90 days after the execution of the contract.

To stimulate commercial financing of defense contracts the assignment of claims act, approved by congress Oct. 9, permits manufacturers to assign claims against the government to banks as security for loans. The banks, under the plan, advance the principal

amount of the loan, collect all payments due the manufacturer from the government as they fall due, apply them to the credit of the borrower, without offsetting deductions, and charge him an agreed rate of interest.

In the case of such financing, it is emphasized that the contract against which a loan is applied must be directly with a government agency. So far, it is understood, the plan has been applied largely to providing additional facilities. It has not been construed as applying to loans for working capital, such as might be needed for the financing of labor and materials and so forth. To assist in the financing of such expenditures, however, the government is allowing an advance payment on a contract of as much as 30 per cent where necessary, with repayment usually prorated over the contract as deliveries are made.

More recently in an effort to avail itself of the facilities of small shops, which not only have equipment which might be utilized but skilled workmen, the national defense advisory commission proposed a plan to utilize the federal reserve organization in lining up these small companies for defense work. With the machine tool industry sold ahead for more than a year and skilled labor scarce, the plan is regarded as having particular merit.

Many, if not all of these small plants are known to the army and navy munitions boards, whose records, of course, are available to the commission. However, the local banks, being on the ground, have up-to-the-minute information with regard to industrial activities in their respective communities which would prove valuable to the plan; moreover, they would be authorized to render financial assistance which these small companies would undoubtedly need over and above their normal credit in handling defense contracts.

■ U. S. S. GRENADIER, left, one of the navy's new submarines, was built in record time. It was launched at the Portsmouth, N. H., navy yard late last year. NEA photo

■ General view of workmen assembling 8-inch guns at the Watervliet, N. Y., arsenal, right. Wide World photo

Priorities on Voluntary System

Priorities have been largely a voluntary and informal matter to date, although controls have been tightened over recent weeks with plans laid for still tighter regulations should the situation warrant.

A priorities board was set up by the President last October, consisting of three members of the commission, Mr. Knudsen, Mr. Stettinius and Mr. Henderson, with Mr. Nelson, co-ordinator of purchases, appointed as administrator of priorities.

This was the first formal move of this character, with the President taking action under authority of the navy procurement law passed June 28. However, even before that a preference rating system had been put into operation by the army and navy and a system of voluntary priorities by members of several industries, especially through action of their individual members. This was true in steel and machine tools.

Later subcommittees were set up for the machine tool and commercial aircraft industries, and now a priorities subcommittee for the steel industry is expected to be announced soon. Similar committees for copper and lead and possibly zinc and rubber are said to be under consideration.

Principal functions of the steel priorities committee, as now indicated, would be to check supply and demand; to encourage and supervise voluntary cooperation; and to prepare a system of compulsory priorities should the need arise.

Two industry committees appointed thus far have been comprised of four members each, two from the industry and one each from the army and navy. Pol-

icies formulated by these subcommittees are submitted to the priorities committee of the advisory commission and, if accepted, are turned over by the latter committee to its administrator for enforcement. The administrator, in turn, passes the policies along to a neutral administrator, who has been appointed for each industry, but who is not chosen from the industry directly concerned.

Dec. 15 priorities control was broadened to cover, if necessary, subcontractors on defense work, as well as primary contractors. This action was by executive order of the President under authority granted him by the navy procurement bill of June 28.

Ratings now in use range, basically, from A1 to A9, inclusive, with the system hinging primarily on delivery dates. In other words, the delivery date specified on the contract sets the priority though other contracts of equal ratings may be ahead of it chronologically.

The priority committee now controls the orders of several hundred contracting agencies, in addition to the army and navy.

Through Leon Henderson, the advisory committee is co-operating with industry in an effort to keep prices stable. For instance, various producers of steel, pig iron, scrap and coke have upon occasion conferred individually with Mr. Henderson and his price stabilization section. On the basis of present costs, representatives of most of the large integrated steel companies believe that present prices are adequate, although some representatives of the small nonintegrated companies do not agree.

■ ACCUMULATION of strategic and critical materials has in general been going ahead satisfactorily, it is said, with perhaps greatest attention focused on manganese, tin, chromium and rubber. Mr. Stettinius reported recently that manganese stocks available to or in this country were sufficient to meet more than two years' requirements, with due allowance for the prospective increase in defense demands; and that tin stocks in this country were sufficient to meet more than one year's demand (some of the large consumers of tin in the steel industry have substantially more than one year's requirements on hand).

Build Stocks of Strategic Materials

In addition to the above mentioned commodities, the list of strategic materials includes coconut shell char, manila fiber, mercury, mica, nickel, quartz crystal, quinine, silk and tungsten. The list of critical materials includes aluminum, asbestos, cork, graphite, hides, iodine, kapok, opium, optical glass, phenol, platinum, tanning materials, tuluol, vanadium and wool.

Strategic materials have the more important ranking and are those in which "dependence must be placed in whole, or in substantial part, on sources outside the continental limits of the United States," and critical materials are "those essential to national defense, but which could be more easily obtained either because of their lesser essentiality or because of more adequate supplies . . ." In addition, there are a large number of "essential" materials, which might become either strategic or critical before the emergency is over. Hence, supplies of these commodities must also be kept under consideration.

Research for substitutions and an investigation of domestic deposits of minerals are being greatly accelerated by the existing emergency.

Under the strategic materials act, $100,000,000 was appropriated for building stockpiles, and, under a law approved last June, the Reconstruction Finance Corp. was authorized to create and finance companies to obtain and store supplies.

As still another measure for building up supplies, the President by proclamation early last July enumerated a number of items which could not be exported from the United States after July 6, without special license. The list included most of the strategic and critical materials, several of the so-called essential materials and various finished products of strategic importance.

Later exports of certain grades of scrap were put under a licensing system, effective Oct. 16. Effective Dec. 30 the same system was applied to iron ore,

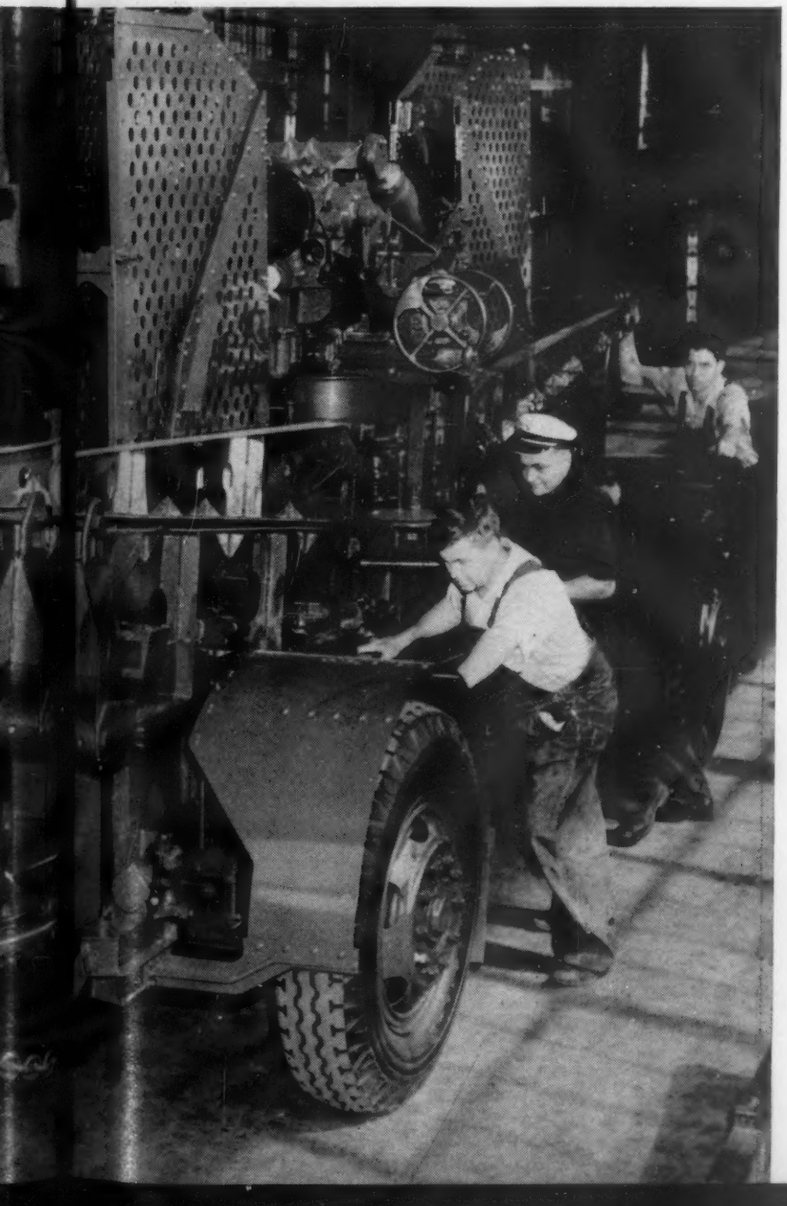
■ Three-inch antiaircraft gun carriages for the army are being produced at the York Safe & Lock Co. plant at York, Pa. Wide World photo

pig iron, various ferroalloys and certain finished and semifinished iron and steel products, although a moral embargo had been more or less in effect for some time on many of these items.

Defense officials also moved to requisition machine tools and certain other defense materials destined for export. Some of these were on piers awaiting shipment when the action was taken. Most types of machine tools are included under the licensing system.

■ WITH the federal gross debt at the end of the last fiscal year close to 43 billion dollars, and with more than 22 billion of it having accumulated since June 30, 1933, the country from a financial, as well as a military standpoint, is in a poor state of preparedness. Consequently the added requirements of defense will come as a heavy burden, although admittedly one that must be assumed.

The two tax laws enacted last year for raising about two billion dollars annually are expected to be but a forerunner of much further tax legislation. The secretary of treasury has several things in mind, including a request to congress to raise the present statutory limit of national debt of 49 billion dollars (it had been raised four billion earlier in the year) to 60 or 65 billion. He has made it clear that while it would not be possible to finance defense entirely by taxation, higher taxes would be necessary.



Incidentally, the debt limit increase question is likely to be approached with caution by congressional revenue committees. When the four billion dollar increase was made last June, congress insisted that provision be made, through new taxes, to amortize this amount of defense borrowing over a period of five years.

The secretary of treasury also has indicated that the new congress would be asked to make all future issues of federal securities subject to taxation, and in November undertook the first financing operation authorized by congress earlier in the year, with an issue of $100,000,000 of 92-day bills, one of a series of such offerings planned.

Meanwhile, business is urging a complete reorganization of the national tax structure with some support for such a move in congress; however, attention to means for speedily raising new revenue may interfere.

In the foreground in any consideration of taxation and general financing for defense purposes is the problem of inflation. Most wars have been financed largely by inflation, and while this country is not engaged in war, its national economy is much affected by one. Secretary of Treasury Morgenthau and Leon Henderson are represented as favoring some means of price control as a measure for preventing inflation. Bernard M. Baruch, as a result of his experience during the World war, has recommended a "price ceiling."

Stabilization of Wages Urged

Competent authorities stress the stabilization of wages (which already does not look too promising) and an extension of working hours, once the slack in employment is taken up.

Perhaps the most orthodox measure proposed is that of imposing heavy taxes, with a view to discouraging spending, thus facilitating government borrowing from real savings. It is a problem which promises to engage the attention of financial and economic experts for practically the life of the emergency.

The first of the two tax laws passed last year aimed at the raising of about one billion dollars for defense purposes through increases in income taxes upon individuals and corporations, higher estate and gift taxes and other miscellaneous levies. Following closely on the collapse of France, it was passed quickly and with relatively little opposition.

However, the second revenue act, the excess profits tax-amortization law, which followed about three months later, aroused considerable discussion, both inside and outside of congress, and has been subject to sharp criticism on some features.

Retroactive in that it applies to all taxable years after Dec. 31, 1939, the law was created to raise about a half billion dollars during the present fiscal year and one billion annually thereafter. To provide the

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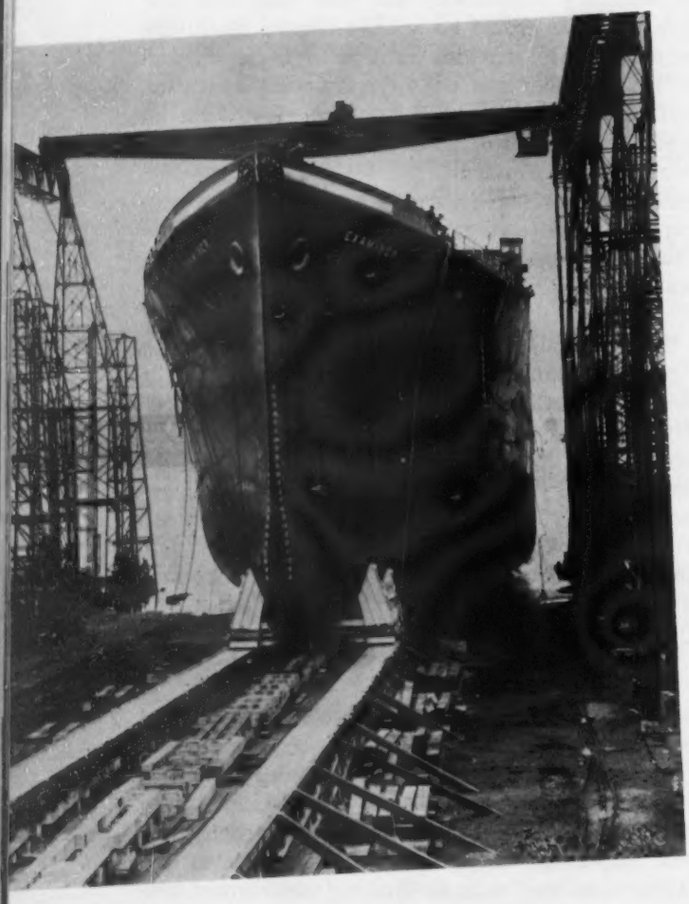
A Year of Plenty



■ NEW PRODUCTION records were set in many industries in 1940—as typified by steel ingot production—and no reverse is in sight so long as the defense program is carried forward as contemplated.

This is doubly true—for not only will the defense program provide a vast amount of business directly, but it will be a major factor in stimulating business indirectly. That is, by increasing the amount of employment it will increase the public purchasing power, thus multiplying demand for all sorts of goods.

Whether defense business will interfere with ordinary peacetime business, and to what extent, cannot now be stated. At Washington there is a growing belief among influential government officials that the defense program should not be allowed to interfere with production of goods for peacetime purposes. They hold that we have plenty of resources in labor and materials, so that the emphasis should be on expansion of our productive capacities of all types. They hold that the government now is in a position to extend any desired or required financial aid to increase productive capacities.

Manufacturers, naturally, still remember clearly

■ Shipbuilding in 1941 must proceed at an unprecedented pace, both naval and merchant ships. At left, the S. S. EXAMINER slides down the ways at Bethlehem Steel Co.'s Fore River yards, Quincy, Mass. Wide World photo. Below, late model small combine, sales of which are expected to continue upward

is Seen Ahead

More than in ordinary times manufacturers are interested in an answer to the question: What are the business prospects for 1941?

That is because of numerous potential factors not yet clearly revealed but which, it is certain, are to have a profound effect in shaping business in 1941. For example, certain influential government officials believe that the defense program must not interfere with peacetime goods production. In fact, they hold, defense expenditures will increase public purchasing power so that a tremendous industrial expansion is necessary to produce all the required goods—and as fast as they are wanted. Again, for example, many companies do not know when and to what extent they will be called on to manufacture for defense.

From all indications, 1941 should be a year of great industrial and business activity—a year full of opportunities. STEEL herewith sets forth a detailed picture of the prospects as they are seen at the turn of the year.

The Editors

what happened after the World war. They remember the headaches they experienced from the huge industrial expansion during that war. They fear the effects of over-expansion in the period when the defense effort begins to taper off. The course and intensity of industrial expansion during 1941, therefore, cannot be foreseen clearly at this time. All that can be said is that the present emphasis is strongly on expansion, with every indication it will continue on expansion for an indefinite period ahead.

The full effect of the defense program on business as a whole has not yet been revealed. It seems evident, however, that many companies which have not yet had defense orders and have not yet begun to think about them will have such orders as the program gains momentum.

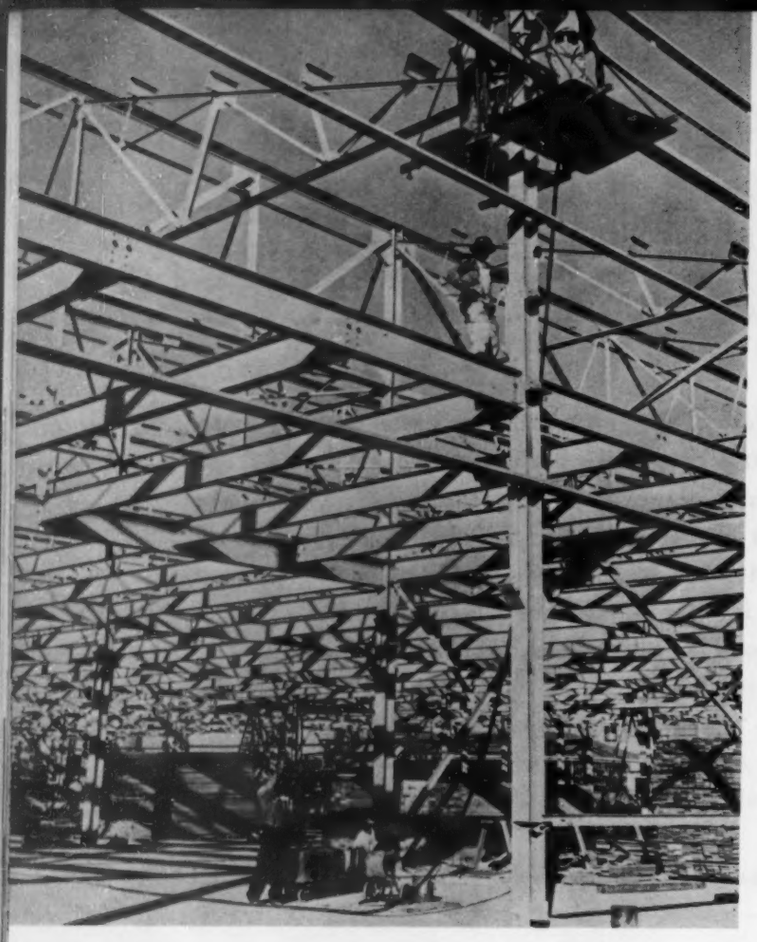
Probably 90 per cent of our industries can contribute directly or indirectly to defense. Obviously, automobile builders and railroad equipment makers can produce tanks; and automobile plants can turn out airplane engines. Companies supposedly associated exclusively with peacetime pursuits can do their share. Refrigerator manufacturers make airplane parts and cartridge cases; vacuum cleaner makers, gas mask parts; business machine manufacturers, pistols, bomb fuses and artillery shells; bicycle makers, machine gun stands; washer and ironer manufacturers, artillery ammunition and components; postal meter companies, bomb mechanisms; printing equipment makers, fire control equipment, artillery parts and machine tools; office furniture makers, bomb containers.

Mechanization in war and defense has never played so heavy a role as now. In 1932 the value of output of the machine tool industry was only $22,000,000; by 1939 it had reached $200,000,000. Within one year after England entered the war this industry had doubled its output. Production in 1940 was well over $400,000,000. It may be $500,000,000 to $600,000,000 yearly by the end of 1941.

Two years ago employment at tool plants was 40,000; today 90,000. It takes machine tools to make tools. Such plants themselves have installed $40,000,000 of new equipment since the defense program began. Moreover few, if any, new machine tool plants were built, but rather idle or storage space was utilized. Considerable work, moreover, has been "farmed out." One of the slogans of the industry is that "skill must be built into machine tools." In other words, the skill of the tools must in part compensate for a certain lack of skill in much of the labor recruited.

High on the list of defense work is construction, since manufacturing operations usually must be enclosed by roofs and walls. This branch of defense went hand in hand with shipbuilding, aircraft assembly and servicing and munitions manufacture. Structural steel orders in 1940 are estimated at 1,700,000 tons and it is believed sales in the first half of 1941 will exceed those in the comparable period in 1940. About 600,000 tons of orders now are on books. Fabricating capacity is approximately 4,000,000 tons annually, and structural shape capacity, 5,805,300 tons.

Expansion of shipbuilding facilities has been a major outlet, having taken at least 155,000 tons in 1940. Of course, actual construction of ships, both



■ Construction already has experienced benefits from the national defense drive, and will continue to do so through most, if not all, of the coming year. At left, structural steel being erected for North American Aviation Inc.'s new plant at Inglewood, Calif. Acme photo

navy and merchant, requires large tonnages of structural steel in addition to the much larger tonnages of plates. The two-ocean navy program, the maritime commission's program and the building of ships for Britain assures continuing high activity in this field.

Aircraft plant construction has been phenomenal. For hangars, base facilities and servicing 100,000 tons of structural shapes are needed. Some observers believe that the peak of defense construction will be passed by July. There is a probability that bridges and public works may be curtailed. Brakes on construction may be higher costs and labor shortages.

New aircraft plants and additions since Jan. 1, 1939 total $318,125,434 and of this amount, in dollars, there are already in operation $83,356,580 worth, the remainder to be in operation by June, 1941. During 1940 aircraft plant employes increased from 60,000 to 165,000. The peak is expected next July at 380,000 but, including subcontractors, 500,000 should be attained. Deliveries of aircraft in 1940 are estimated at $625,000,000, against $225,000,000 in 1939 and $130,000,000 in 1938.

Railroads are placed high on the list of defense facilities because of need for transportation of raw materials and finished products. John J. Pelley, president, Association of American Railroads, has stated: "Both hauling capacity and terminal capacity of the railroads are ample for needs far beyond any that might be anticipated."

Railroad equipment makers are now turning out military tanks, shells, bombs, etc.

Automobile builders now are manufacturing scout cars, tanks, aircraft engines and parts and other defense items. The Chrysler $20,000,000 tank plant will be completed in October, 1941, ready to begin on the government's $33,500,000 order for 1000 25-ton tanks.

Optimistic predictions are made by automobile companies. Thus, 1941 will mark an all-time high for Cadillac business. Oldsmobile's record year in 1940 will be topped this year. Crosley expects 1941 to be better in all its lines—radio, refrigerators and automobiles. Packard predicts 1941 a "banner year."

Meanwhile, defense cannot be well balanced without yeoman service from agriculture. A year ago the farm industry looked for a 10 per cent gain in 1940; 20 per cent was attained. A 10 per cent rise is forecast for 1941.

Domestic farm equipment sales in 1940 are estimated at $492,000,000, best since the 1937 record of $507,000,000. Sales of smaller tractors for small farms tip the balance. Though acreage in 1940 was 7 per cent under predrouth level, yields were more bountiful than any year save 1937.

Department of agriculture predicts farm income in 1941 higher than 1940, perhaps best since 1929. Farm buying power is the best in 20 years, with greater diversification of crops in the South. More steel and metals will be used on the farms for labor saving machinery, because of greater electrification,

■ To haul the materials and products of national defense, American railroads have ordered thousands of all-steel freight cars. Depicted below is scene at the Pennsylvania railroad's shops near Harrisburg, Pa.

■ Keystone in our national effort to produce a lot of defense material in a hurry—the machine tool. Builders last year produced a record volume of these master tools of industry, will reach new peaks this year

smaller fields which means more fencing, greater refrigeration, wider adaptation of machinery to farm work.

The past year was one of the best in history for sales of containers. The "pack" of the season, on the basis of No. 2 cans, was 103,000,000 cases as against under 95,000,000 in 1939. Production of beer cans last year was an all-time peak at over 750,000,000. Increasing use of canned juices swells consumption also. During the first ten months 83 per cent of tin plate manufacture was of cold-reduced plate, against 76 per cent in 1939 and 58 per cent in 1938. This material calls for less pig tin for coatings.

Finally, under heading of miscellaneous, come important metal consuming industries such as household appliances, business machines, air-conditioning equipment and the like. In the first eight months of 1940 refrigerator sales passed the former record in 1937 of 2,203,325 units, the average refrigerator requiring 190 pounds of steel. Range sales were 25 per cent over 1939; washing machines gained 10 per cent and mechanical stokers, 25 per cent.

Machine Tool Output To Expand Further in 1941

■ MACHINE tool industry during 1940 moved into the front rank of national defense. While this has been true to some extent in previous emergencies—especially in the first World war—it never has been to any such degree as at present.

There are two reasons for this. One is that never before has mechanization played such a lead role in national defense. The other is that never before did need for national defense strike home to the American people so suddenly and so forcefully as following the collapse of France last summer.

Demands on the machine tool industry during the past seven months have been sensational; so also has been the response of the industry. The record of accomplishments by the machine tool builders in this respect is deserving of appreciative examination, especially in view of a thoughtless tendency on the part of the public press to use the word "bottleneck" in connection with this basic industry.

When compared to other key industries such as steel and automobile manufacturing, the machine tool industry is small in proportion to its importance. In 1929, one of its previous peak years, its dollar volume of production amounted to only $185,000,000. Considering that it is the industry which builds the machines used to build all machines, its downward fluctuations during depression periods are as astonishing as its upward surges during periods such as the present. From its $185,000,000 peak of 1929, it slipped to a low of $22,000,000 in 1932. It was from that low level, with even its skilled help scattered, that the industry had to rebuild itself to the $200,000,000 level reached in 1939.

The 1939 figure, which up until that time represented an all-time high for the industry, was due to a combination of improving domestic business plus orders from abroad growing out of gradually accelerating armament programs. The latter business, as far as England and France were concerned, increased substantially following outbreak of European hostilities. What this meant in terms of 1940 can best be expressed by the statement that within one year after England entered the war, the American machine tool industry had doubled its production.

As a result, total output for 1940 exceeded $400,000,000. There is a distinct possibility that it may rise to $500,000,000 or $600,000,000 for 1941, if the present rate of increase continues. Except for a gain which occurred in 1937, the curve representing values of machine tool shipments from 1932 through 1940 and projected on into 1941 has much the appearance of a rising parabola.

The story behind these figures is a saga of American industrial resourcefulness. It is a story involving men and machines and plants—but that part concerning men is the most significant. In order to build machine tools which can be operated by persons of very limited skill, skill must be "built into" the machine tools. That means that an unusual amount of skill is required of those who build the machine tools.

Two years ago the machine tool industry in this country was employing less than 40,000 men. Even then the necessarily skilled help was growing scarce. Today that figure stands somewhere in the neighbor-

(*Please turn to Page* 374)

Windows of *WASHINGTON*

By L. M. LAMM
Washington Editor, STEEL

Government's Policy Toward Nation's Business Is Riddle Yet Unanswered.

Backing by Industry Essential to Successful Defense Program.

New Tax Sources Sought in Effort To Provide Billions for Rearmament.

Congressional Appropriations Far in Excess of All Peace-Time Records.

WASHINGTON

■ GOVERNMENT'S attitude and policy toward business continues an important and unanswered question as this momentous year begins. It is a question that can be answered only by the President, and he is silent.

General belief in Washington, however, is that for the time being the President is not considering any major changes affecting industry but will make an effort to consolidate New Deal activities and social gains.

Some observers believe the Corcorans and the Cohens and their friends have lost favor at the White House, and, if this is true, it means a lot to industry. Most New Deal anti-industry legislation was supposed to have emanated from and to have been drafted by these Left Wingers and their friends.

Absorbing interest during the past eight months has been in the national defense program. This has given rise to many matters of paramount interest to all industry, including amortization of new defense plants, now believed to be satisfactory to business.

Steel orders arising from the defense program have totaled hundreds of millions.

Leon Henderson, watchdog on price for the national defense advisory commission, has held many conferences dealing with scrap, pig iron, nonferrous metals and similar products. The commission has set up priority boards for various industries which are to operate only in case of necessity.

Reconstruction Finance Corp. was authorized by congress to purchase strategic minerals and through a subsidiary metals corporation actually has made many purchases, details of which have not been made available. These purchases are said to include considerable tonnage of domestic manganese ore which in some cases will allow domestic producers to reopen their mines.

The President, of course, wants and must have the backing of business for the defense program, and he and other members of the administration have apparently felt that industry is back of them in this undertaking. In fact, they have expressed their appreciation publicly many times.

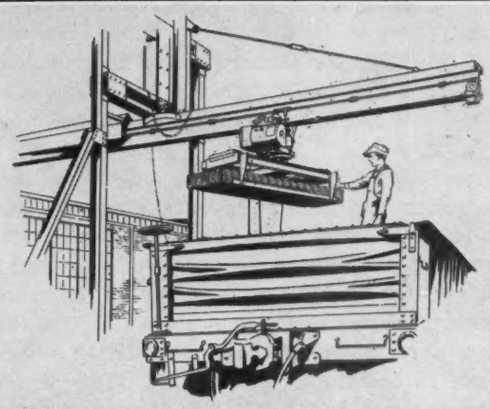
New session of the 77th congress convened on Jan. 3 in accordance with the provisions of the constitution under the "lame-duck" amendment. First session of the 76th congress began Jan. 3, 1939, and adjourned on Aug. 5. The second session began Sept. 21, 1939, and ended Nov. 3, 1939. The third and last session began Jan. 3, 1940. At the beginning of the new congress, the legislative slate was entirely clear. That is, when a congress ends (not a session) all pending legislation before both houses automatically is killed, with the exception of treaties which may be pending before the senate.

Two tax bills were passed at the last session and there is every indication another one will be taken up during the new congress. In view of the fact, however, that such a short time intervenes between now and March 15, the beginning of the tax year, it is unlikely a new bill can be enacted to become effective March 15.

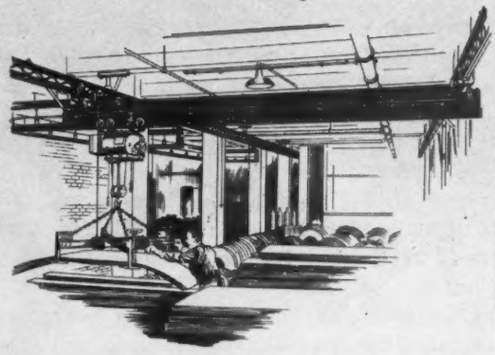
Conference on taxes has been held at the White House between President Roosevelt and administration and congressional tax experts. Following this it was announced officially that corporations need not fear any further increases in 1940 taxes; in other words, any new tax will not be retroactive for 1940.

Sharp increases, designed to help meet defense-swelled expenditures, appear to be almost certain for taxes on 1941 incomes.

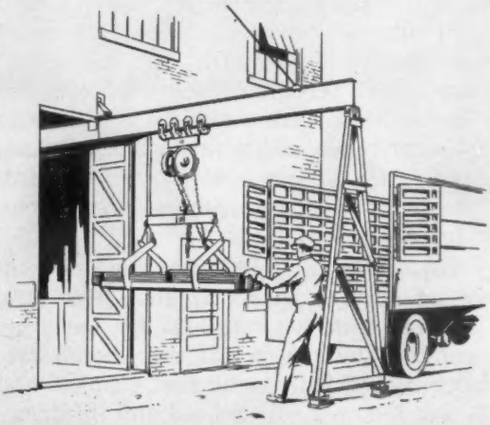
Basic 25 per cent corporation income tax rate and



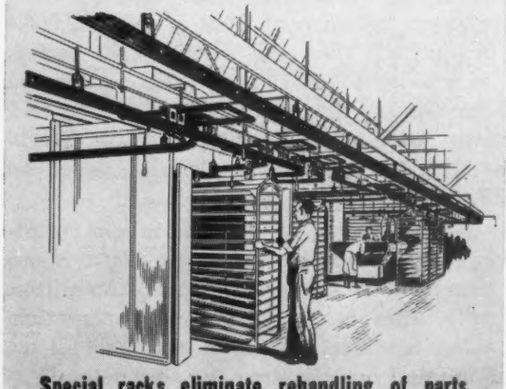
3-ton bundles of steel sheets unloaded quickly without damage.



Crane interlocks with spur tracks for safe movement of stock.



Retractible crane reduces cost of unloading steel from trucks.



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the graduated levy on individual incomes starting at 4.4 per cent, will stand for 1940 incomes. First installments on income taxes will fall due March 15.

Pat Harrison, chairman of the senate finance committee, said congressional committees will begin work on legislation affecting 1941 incomes this month. It is generally believed that many tax rates will go up when the measure is enacted. The size of the increases probably will not be determined finally until after the March 15 returns are in.

Senator Harrison said discussions at the conference were "general" and no decisions were reached other than that regarding 1940 incomes.

Last year's incomes were subjected to retroactive taxation in both the first and second revenue acts. The initial legislation imposed a 10 per cent defense "supertax"; the second increased corporation income taxes and imposed an excess profits levy designed to prevent the creation of "war millionaires."

Congressional committees also will give special consideration to the overlapping of federal and state taxes.

A goal of $10,000,000,000 in revenues for the next fiscal year—about $3,000,000,000 more than the most liberal estimate of the amount likely to be raised during the current fiscal year, has been mentioned. Against this, expenditures were expected to exceed $13,000,000,000 for 1940 and may be even higher this year.

During the past year a number of developments of particular interest to the steel industry—in addition to the all-important national defense program—have occurred in Washington. One of these was the decision of the United States Supreme Court upholding the new minimum wages ordered by the secretary of labor under the Walsh-Healey act.

Another was the licensing of the export of iron and steel scrap, ferroalloys and certain manufactured and semimanufactured iron and steel items. Scrap control had been agitated in congress over a long period.

Small Taxes for Another Billion

There can be no doubt that the Chief Executive in the past has been bitter in his attitude toward industry. However, during the months just preceding the election, he made practically no adverse mention of business, although before that he had seized every opportunity to "knock" industry and took especial delight at his semiweekly press conferences in "cracking down" on the attitude of business toward his administration. Industry generally has opposed Mr. Roosevelt and his policies and his resentment has been apparent.

Although the new tax revision has not yet taken form it is reported the administration will want at least another billion dollars from the nation and it is said in authentic quarters that individual incomes, excess profits and corporate taxes will be tapped again in the hope that these sources will bear the brunt of the burden, with a good many smaller taxes grouped together helping to make up the extra billion wanted. This possibly means the re-enactment of some of the many nuisance taxes.

Secretary of Treasury Morgenthau has committed the administration to seek more revenue. He will also present his plan for increasing the federal debt limit $15,000,000,000 to $20,000,000,000 above the present $49,000,000,000, to finance the defense program.

Upward revision of the recently-enacted excess profits tax is taken for granted by treasury officials. From this revision alone, they hint, the revenue possibilities may run as high as $500,000,000.

Corporate excess profits tax, together with the increased corporate income tax enacted with it a few months ago, were said by some to necessitate a similar increase in individual income tax rates which might bring in upward of $100,000,000 more revenue.

Many New Plans Being Considered

Officials say while the excess profits law is designed to capture a portion of the extra profits apparently ahead for corporations as a result of the defense program, nothing had been done to tax similar profits which individuals might reap from the preparedness spending.

Others argue that the individual income tax law takes care of such situations automatically, because its graduated rates, from 4 to 79 per cent, increase with personal income.

Although congress has been reluctant, Secretary Morgenthau and the administration have indicated their intention of seeking legislation to tax the income from all future issues of governmental securities. If enacted, however, this levy would not produce much for several years, or until the volume of new securities reached high totals.

The President and certain members of congress are of the opinion that there should be amendments to the social security act which would be in the nature of expanding the old-age benefit base. The federal security agency as yet has presented no recommendations for changes.

To every request for defense funds the last congress responded liberally in six appropriation bills. Beginning in June with separate bills for the army and navy, congress by the end of that month provided more money for both in its first supplemental defense bill, and followed with second and third supplemental bills and an emergency bill to provide for housing men selected for training. For defense, congress within four months provided $8,334,000,000 that can be spent before next July and $3,802,000,000 more in contracts that can be let in that period. The total is around $12,136,000,000. Congressional provisions for defense have exceeded by 50 per cent the provisions made on our entry into the World war by the congressional session that adjourned on Oct. 6, 1917.

No delay can be ascribed to congress in appropriating defense funds from the treasury. Each house depended largely upon its appropriations committee, and repeatedly, after hearing a general explanation, passed in a few hours bills running into the billions. The actual outgo from the treasury for defense as a matter of course, could show no such acceleration. It was $153,000,000 in June, $177,000,000 in July,

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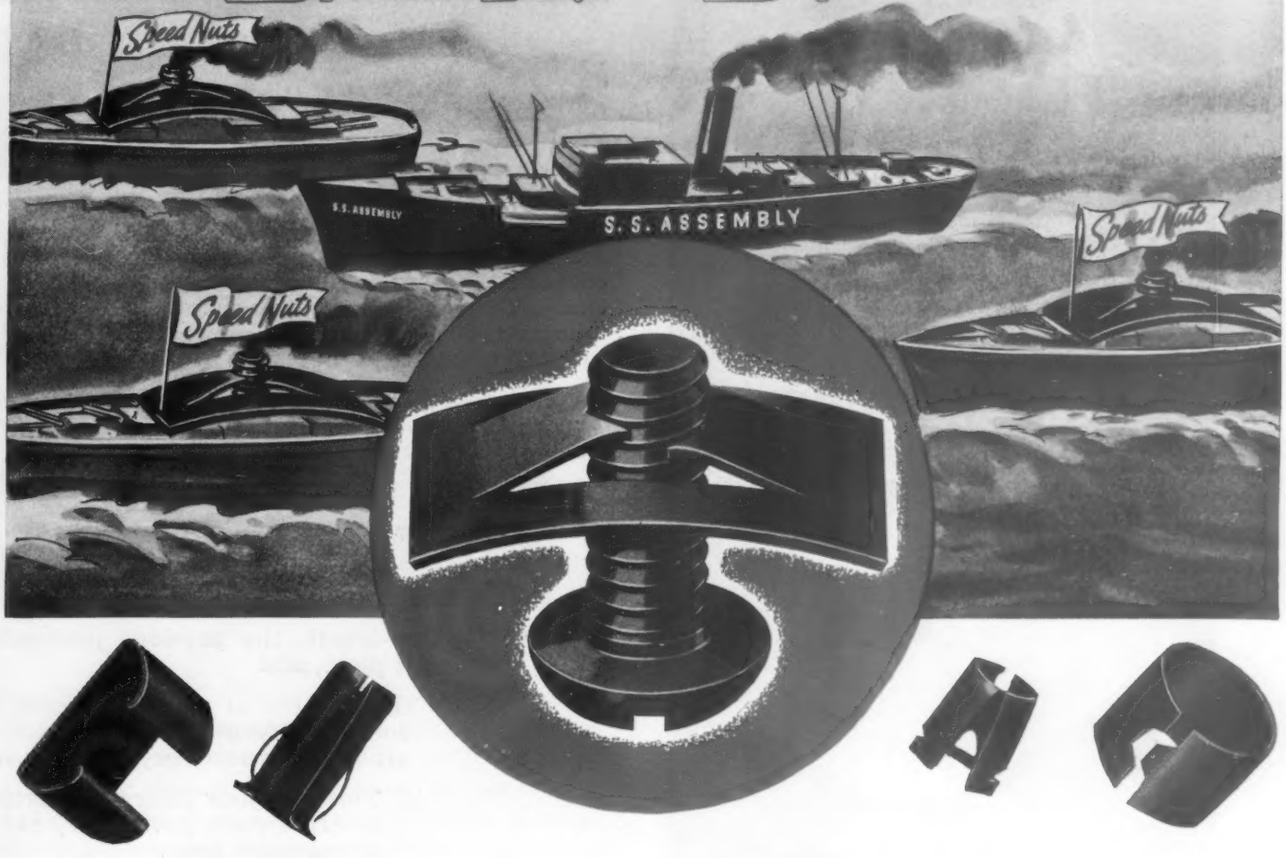

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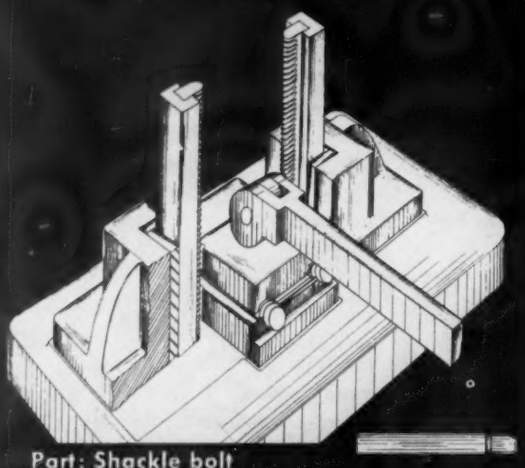
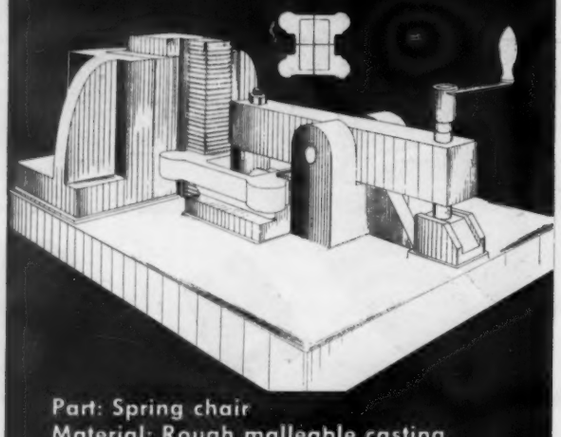
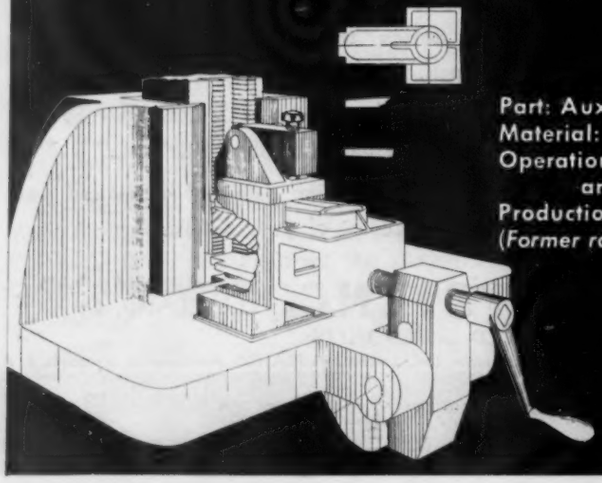
BROACHING PAYS



Part: Shackle bolt
Material: Machined steel
Operation: Broach ½ round, 2 at a time
Production: 160 per hr
(Former rate by milling: 50 per hr)



Part: Spring chair
Material: Rough malleable casting
Operation: 1. Broach slot sides
2. Broach slot opposite sides
Production: 60 pcs. per hr
(Former rate by milling: 15 per hr)



Part: Auxiliary spring chair
Material: Rough malleable casting
Operation: Broach both sides upper and lower arms in one pass
Production: 45 per hr
(Former rate by milling: 14 per hr)

. . . ONE BROACHING PRESS *with* 7 *different* FIXTURES *processes* 7 *different* PARTS *in* 60 *different* SIZES

Job-lot processing by broaching *is* profitable. Both initial cost of equipment and cost of processing can be reduced compared with milling—with the added advantage of increased productive speed, so important these days when productive facilities are heavily taxed.

In one well known plant, a single Colonial Utility type Press of 15 ton capacity and 36 inch stroke has supplanted milling machines for processing—

(1) Seven different trailer parts, in

(2) Sixty various sizes, in

(3) Job lots usually ranging from 300 to 1000 parts, at

(4) One-fourth the previous processing cost per piece, and

(5) With an initial equipment cost of one-fourth of former milling machines including the necessary fixtures, at

(6) *Three to four times the former productive rate per hour, including change-over time.*

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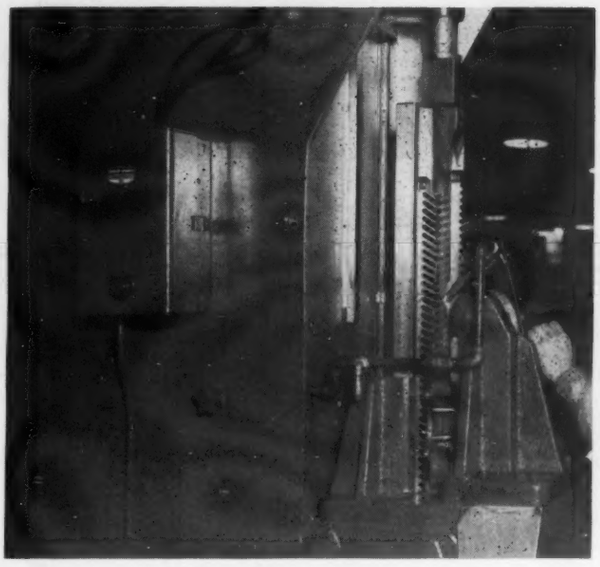
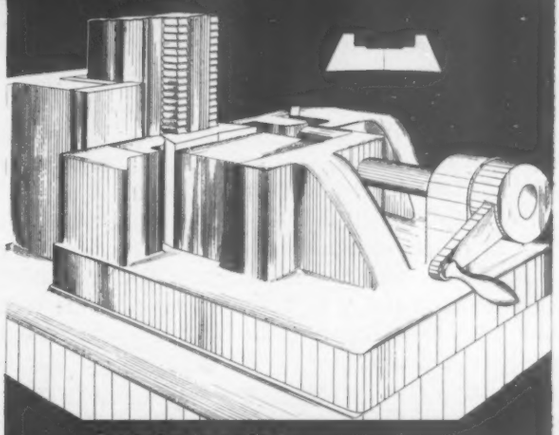
S FOR JOB-LOTS TOO

Yes, broaching machines are both high-production and flexible job-lot tools. For different parts, only the fixtures need be changed. The design of the platens, columns, beds are such that quick replacements can be made,—insuring minimum set-up time.

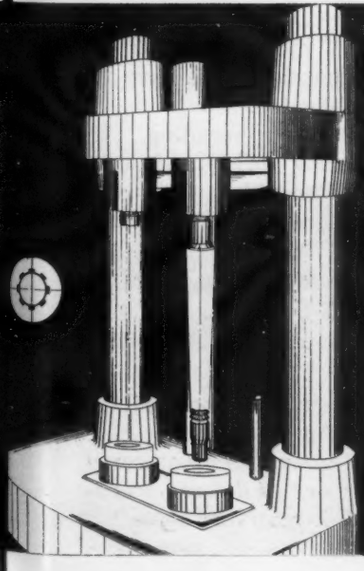


When small lots in a variety of forms or sizes must be processed quickly and inexpensively, Colonials with the right fixtures are proving the answer. Colonial has a corps of engineers at your service, and welcomes the opportunity of applying their specialized knowledge of job-lot production problems to your machining requirements.

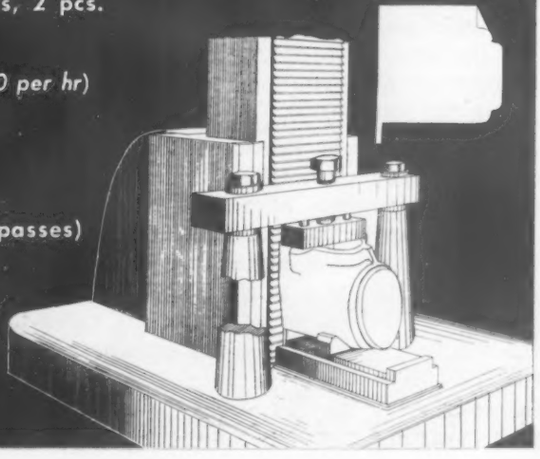


Part: Spring chair
Material: Rough malleable casting
Operation: Broach inner face
Production: 45 per hr
(Former rate by milling: 14 per hr)

Part: Anchor pin bracket
Material: Rough malleable casting
Operation: Broach two faces
Production: 50 per hr
(Former rate by milling: 10 per hr)



(Left) Part: Slack adjuster gear
Material: Machined steel
Operation: Broach internal splines, 2 pcs. at a time
Production: 200 per hr
(Former rate by single pull broach: 50 per hr)



(Right) Part: Gear housing
Material: Malleable iron casting
Operation: Broach 2 faces (2 passes)
Production: 40 per hr
(Former rate by milling: 10 per hr)

$200,000,000 in August, and $218,000,000 in September.

Of the $8,334,000,000 in immediate funds, the war department received by far the greater part, $5,720,000,000. That sum, with $2,979,000,000 more for authorized contracts, is estimated to provide complete equipment in items normally produced commercially for 1,400,000 men and to maintain them on a combat basis, and the reserve stocks of critical items not normally produced commercially for a ground force of 2,000,000 men, raise serviceable army airplanes to 25,000, with necessary pilots.

To the navy's $2,631,000,000 in cash and its $822,000,000 in authorized contracts, there are later to be added $4,586,000,000 and more for the remainder of the two-ocean navy, that figure being the present general estimate without additions for costs of expediting construction.

Reports are the President will ask the new congress for some $15,000,000,000, of which $8,000,000,000 will be exclusively for national defense. In addition to this some $2,000,000,000 will be needed for the public debt interest, making a total of $17,000,000,000 needed at this time. More may be needed later.

In addition to regular and new defense demands, the new congress will have to supply cash for most of the $4,000,000,000 in contracts it authorized for the army and navy last year.

Large sums will have to be allotted to the navy for construction of the two-ocean navy, and it is unofficially estimated that problably $1,000,000,000 might be asked later for establishment of air and naval bases on eight British possessions in the Western hemisphere.

While the last congress voted about $15,000,000,000 for defense in cash and authorizations, it pointed out that much of this money would not be expended until the 1942 fiscal year and that many items, such as building barracks, would not recur.

It is suggested that developments in Europe's war may necessitate supplemental requests for funds that might boost the outlays to an unforeseeable amount.

Original Budget Far Exceeded

President Roosevelt's original budget last January called for only $8,424,000,000, exclusive of interest on the debt and trust funds, but the defense and regular government needs, including relief, brought the total to $18,311,795,000, plus $4,059,000,000 in contract authorizations for a grand total of more than $22,000,000,000.

In addition, it is said, President Roosevelt will ask $350,000,000 more for relief for the current fiscal year.

All civil departments have been ordered by the President to pare their estimates where possible, in order that the defense needs can be better met. They are to be held to a total of $7,000,000,000.

Last session of congress broke all peace-time records for spending. It gave the government more than $25,000,000,000.

The grand total—for defense and civil purposes—included $16,920,627,477 in direct appropriations, $4,066,191,060 in contract authorizations and $4,586,000,000 representing the cost of the two-ocean navy which the last session of congress authorized and which will not be completed for several years.

Only once before in history has a congress committed the government to such a large sum. The second session of the 65th, at the height of the World war in 1918, appropriated $27,092,094,720 in cash, to which it added $9,027,441,362 in contract authorizations, for a grand total of $36,119,536,082.

In enacting the largest appropriations and contract authorizations during peace-time, congress recognized the urgent necessity of the rearmament of the United States and the strengthening of defenses for hemispheric protection. Little opposition to the provision of these sums appeared.

Last congress exceeded President Roosevelt's budget estimates by a net of $641,519,461. However, it is said a part of this sum was due to defense appropriations on which the Executive furnished information informally.

Army Contracts Promptly Placed

It is reported in authoritative sources army officials already have placed orders for more than 71 per cent of the planes, tanks, barracks, supplies and other war materials for which congress provided funds at the last session. For purposes other than the army's ordinary maintenance expenses, the war department has awarded contracts since July 1 for a total of approximately $4,500,000,000.

Such reports as are available indicate that virtually all of the contemplated 6000 new tanks for the army are in process of manufacture or plants and machinery are being created to build them. Aircraft manufacturers have orders for approximately 20,000 airplanes for the army, including combat and training planes, while the navy has contracted for 7000.

Such figures as are available show also that 26 powder factories and other munition facilities are under way, costing some $750,000,000.

Army still has some $2,000,000,000 unexpended for war materials, some of which will finance new facilities to produce munitions.

Navy has spent more than $4,000,000,000, while more than $10,000,000,000 of the $16,000,000,000 voted at the last session of congress for the navy to reinforce defenses have been obligated.

Concentrating on strictly military spending, the President said that by the coming spring and summer the defense program will be able to use the greater number of people who are out of work and need jobs.

The President's announcement fits into the defense fiscal picture already proposed by the administration's leading congressional spokesmen on finance and appropriations.

He proposes to save money now on nonmilitary works, but to approve engineering plans on the best of these and file them away for use when necessary to take up any work lag at the end of defense spending. These will serve as a work reservoir against a post-war depression.

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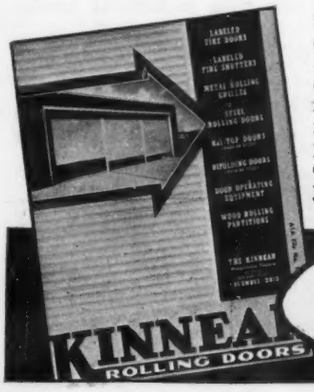
Their rugged, all-steel, interlocking-slat curtains **stand up** under the wear and tear of industry's toughest door requirements. And it gives greater protection against intrusion riot, sabotage, fire, accidental damage and the elements.



There are big advantages in the vertical, compactly coiling operation of Kinnear Rolling Doors, too. It saves floor, wall, and even ceiling space; materials can be stored within a few inches of the doors at any point without obstructing their operation. The doors open completely out of the way of all plant traffic and other activities. And they are never hampered by snow, ice, or swollen ground.

On top of all these features, Kinnear Motor Operated Rolling Doors give you the labor saving, time saving convenience of remote control. You can open the doors from any number of convenient points, at the touch of a button!

Kinnear Rolling Doors are available in any size, for quick, easy, economical installation in any opening, in old or new buildings. Write at once for complete details!

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The KINNEAR MFG. Co.
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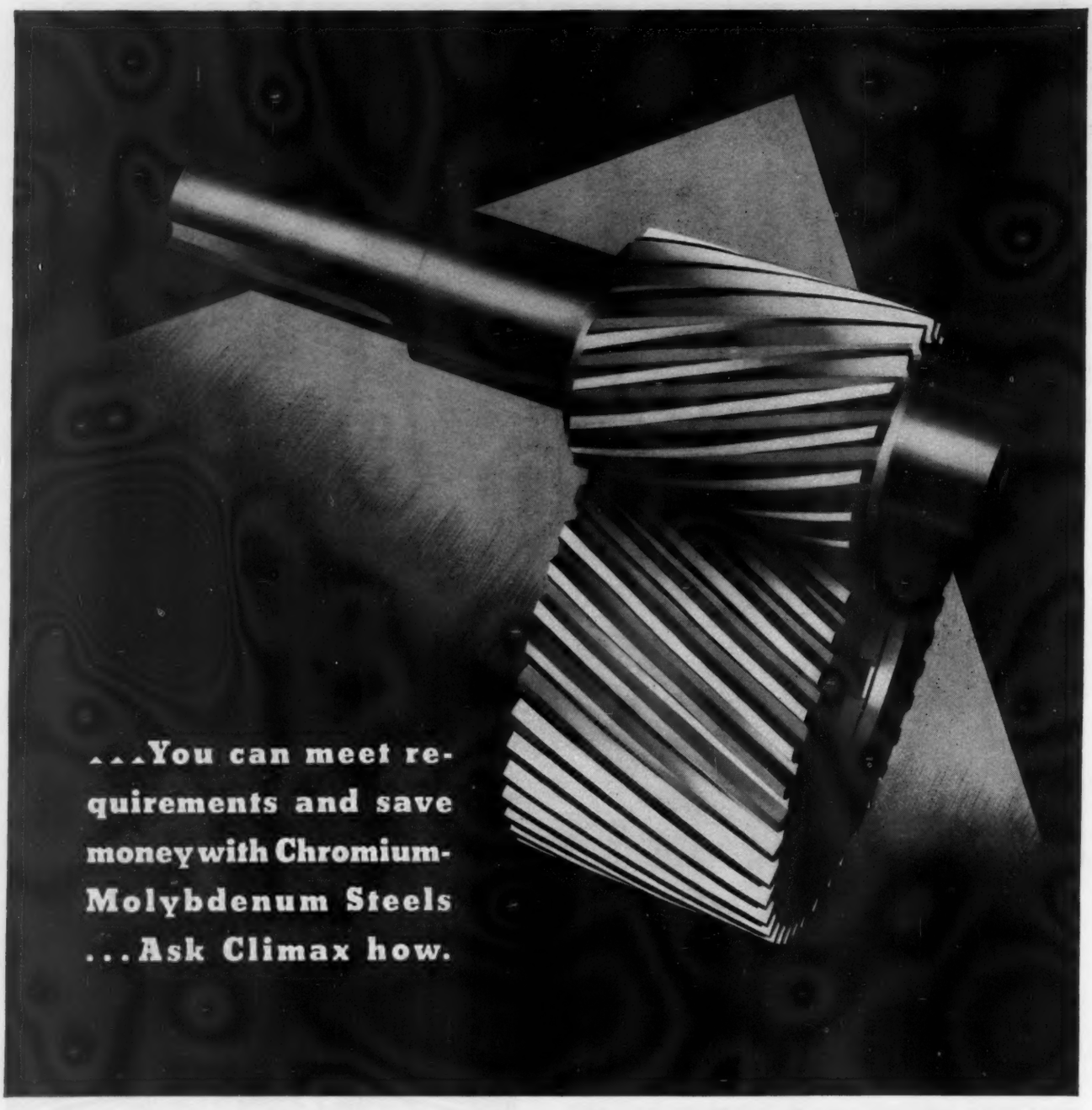

An example of economy with serviceability by standardizing on Molybdenum steels: a manufacturer of speed reducing equipment uses Chromium-Molybdenum, SAE 4140, for gears and SAE 4150 for pinions.

Treated to 24-28 and 28-34 Rockwell "C" respectively, these two readily available, low cost and easily machinable steels comfortably meet the toughness and hardness requirements of the service.

Write for your copy of our free technical book, "Molybdenum in Steel".

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MOLY

Mirrors of *MOTORDOM*

By A. H. ALLEN
Detroit Editor, STEEL

Automobile Industry's Defense Orders Total 18 Per Cent of 1940 Output.

Car, Truck Assemblies Exceeded 4,600,000, Up 23.3 Per Cent.

17 Per Cent Decline in 1941 Automobile Assembly Volume Indicated.

Basic Labor Situation Shows Improvement, but Is Still Unsettled.

DETROIT

■ WAR in its 1941 model is fundamentally a contest of internal combustion engines. Wherever the crushing foot of Mars has trod in the past two years there has been the accompanying roar of engines—in bombers, fighting planes, tanks, motorcycles, combat cars, trucks, torpedo boats, even in submarines where the steady throb of diesels at the surface is vital to power supply for diving and cruising.

Charles F. Kettering, General Motors philosogineer and head of the corporation's research activities, said recently: "Whenever man's inventive brain creates a new weapon, there is a new war. This is the war of the airplane."

Another nimble-thinking automotive engineer, Fred M. Zeder of Chrysler Corp., goes a step further when he declares: "This brand new kind of warfare, predicated as it is around the combustion engine, is right down our alley. Who conceived the airplane, who conceived the tank and the submarine? Surely we ought to know our own babies a little better than the other fellow."

Sixty per cent of the internal combustion engines built every year in the entire world come off test blocks within the United States, a figure to which every world statesman, including A. Hitler, has access. A military challenge to match engine resources with this country is like a flea sparring with an elephant.

But a challenge at least has been scented and the United States military has turned to the motor industry and said, "All right, boys, they are asking for it; let's have it." And, disastrous though every industrialist knows the expenditure of billions for armament and defense equipment to be on the national economic health, if not now, then three, four or five years from now, the wheels are turning and the engines, the guns, the trucks, the armored cars, the bombers, the pursuit ships are starting to roll from assembly lines. When and where they will be shot to pieces, or will rust away in idleness, are questions which must be brushed aside in the ecstasy of arming for total defense.

How big a job has the motor industry taken on? Well, a dozen years ago, in 1929, the motor industry turned out three billion dollars worth (wholesale value) of passenger cars and six hundred million dollars worth of trucks. Last year the industry assembled about two and a quarter billion dollars worth of passenger cars and $550,000,000 worth of trucks and commercial cars. Since last July 1, military orders for trucks alone received by Michigan plants have aggregated about $70,000,000 or 13 per cent of total 1940 output value. This proportion should be reduced further in view of the fact outputs cited are expressed

Automobile Production

Cars and Trucks, U. S. and Canada

	1929	1937	1939	1940	1941†
Jan.	422,538	399,186	356,962	449,492	375,000
Feb.	497,705	383,900	317,520	422,225	350,000
March ..	626,076	519,022	389,499	440,232	425,000
April	663,811	553,231	354,266	452,433	450,000
May	636,250	540,377	313,248	412,492	350,000
June	567,424	521,153	324,253	362,566	250,000
July	518,301	456,909	218,600	246,171	200,000
Aug.	512,842	405,072	103,313	89,866	100,000
Sept.	429,729	175,630	192,679	284.583	200,000
Oct.	394,540	337,979	324,689	514,374	325,000
Nov.	226,997	376,629	368,541	479,632*	400,000
Dec.	125,502	347,349	469,118	450,000*	400,000
	5,621,715	5,016,437	3,732,718	4,604,066*	3,825,000

* Preliminary. †Estimate by STEEL.

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in wholesale value, while military orders are retail.

Total army and navy contracts placed with Michigan plants since July amount to about half a billion dollars or roughly 18 per cent of wholesale value of the auto industry's entire output for 1940. It would appear that on the basis of the present rate of awarding contracts—and they probably will slow down now that the initial hump has been cleared—the motor industry should be able to accommodate the business in stride, not seriously affecting regular manufacture.

On top of arms contracts already placed has come a vast aircraft parts program which the auto industry has agreed to launch. Involving subassemblies and parts for some 24,000 large bombing planes, the program has been estimated to approximate half a billion dollars in size, or the equivalent of army and navy business already placed with Michigan plants. It should be remembered that a good proportion of all this business will be allocated to parts plants and body builders, not directly to the motor industry.

Keeping these figures in the foreground, it may be well at this point to take a look at what the industry has done in the past year and to take a flyer on what seems in store for the next 12 months.

In 1940, the industry pushed past the 4,600,000 mark for car and truck assemblies, an increase of 23.3 per cent over 1939 and well beyond estimates being made at this time last year. Reviewing month-by-month production statistics, shown in the accompanying tabulation, several facts stand out: First, the exceptionally even rate of assemblies the first five months of the year, no month varying more than 5 per cent from the average of 435,335. Second, the precipitate drop from the high level of May into the changeover valley in August when fewer than 100,000 units were built. Third, the equally sharp climb to better than 500,000 units in October; and fourth, the amazing strength shown for the last three months of the year when most companies were breaking all production records.

Now, as far as this year is concerned, a careful stirring of all factors now evident, plus admixture of past performances and a sprinkling of private official opinions, yields the 1941 cocktail—perhaps a little too bitter for some, yet withal zestful and stimulating—total production of 3,825,000 cars and trucks, or a decline from 1940 of 17 per cent.

Obviously a difficult matter to forecast accurately and one which is generally shied away from by even the best statisticians, the outlook herein presented is obtained by balancing the reasons for expecting a decrease against the reasons for anticipating an advance. Taking the latter first, they are:

1. More jobs because of the defense program, resulting in more income and more money to spend—on automobiles.

2. Auto transportation has become practically a necessity for the workingman, and with work the theme for 1941, car sales will benefit.

3. Important increases in numbers of trucks required by the defense program and by private haulers. Last year truck production totaled around 850,000, still short of the 947,502 built in 1937. The government now has a program involving some 200,000 trucks for military use, about half of them already ordered.

On the red side of the ledger are the following:

1. The past year was the last in a three-year cycle of increasing production, a phenomenon which has prevailed over the past 20 years. The current year should be the first of three declining years, or should see a new low base established for the ensuing two-year climb back to a peak.

2. In the major defense plant projects now under way in the motor industry, it is likely a considerable "borrowing" of auto production labor will be required. This conceivably might restrict the ability to turn out new cars in quantity comparable with last year.

3. Many buyers took delivery of cars last fall in advance of their normal buying time, because of real

■ **Scout cars built for the army by White Motor Co., Cleveland, mount three machine guns, are fully armored and are capable of 50 miles per hour with full load. Roller in front is to assist in operation over rough terrain**

YOU CAN DEPEND ON INLAND STEEL

Step by step, from mining raw materials to final inspection, Inland steelmaking processes are under the control of skilled metallurgists and steelmakers. This is why steel specified from Inland is always the same from heat to heat, and from year to year. It is this watchfulness over quality and uniformity which leads many manufacturers to depend on Inland for their steel requirements.

INLAND PRODUCTS

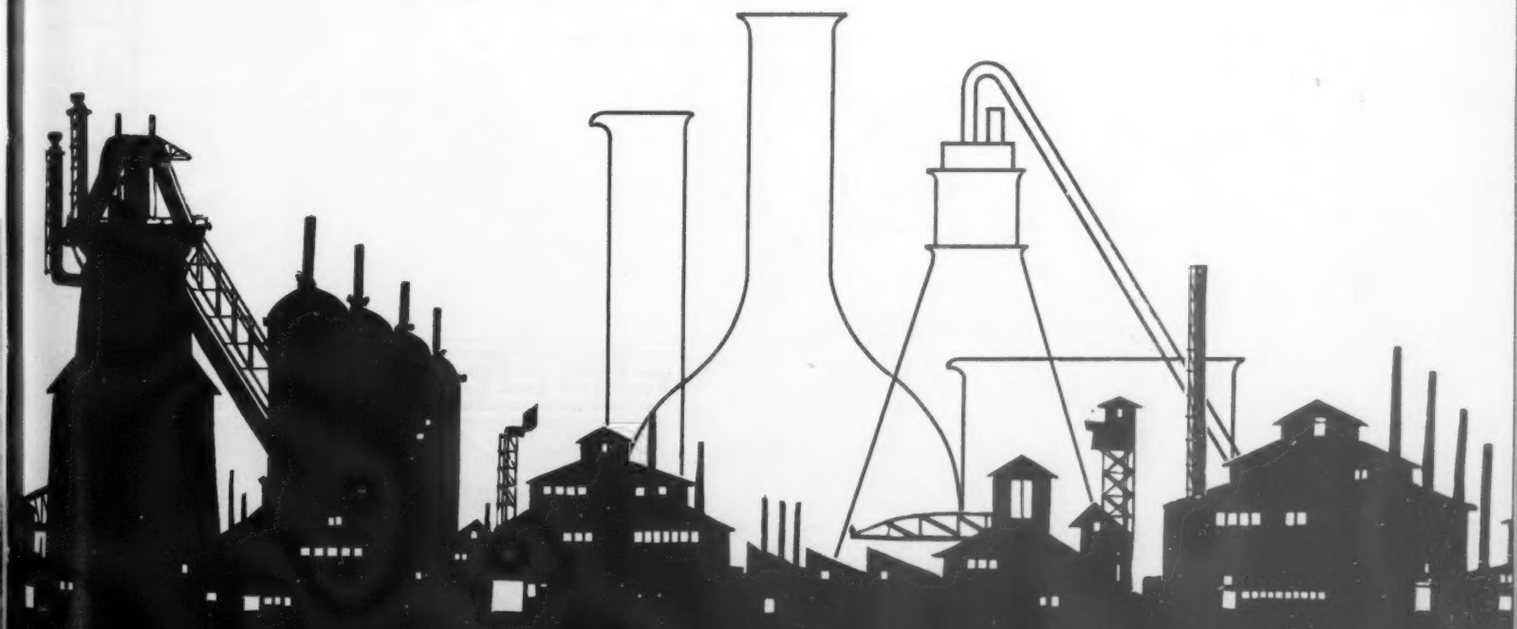
Bars, Plates, Structurals, Inland 4-Way Floor Plate, Sheet Piling, Reinforcing Bars, Rails, Track Accessories, and Rail Steel Products.

SHEETS AND STRIP

Hot Rolled, Cold Rolled, Galvanized, Form-Cote, Paint-Tite, Zinc-Alloy, Electrical, Enameling Iron, Tin Plate, Tin Mill Black Plate, and Terne Plate.

SPECIAL STEELS

Copper-Alloy (high corrosion resistance). Hi-Steel (low-alloy, high-strength, exceptional resistance to corrosion and abrasion). Ledloy (lead-bearing, fast machining, open hearth steel). Silico-Managanese Steels.



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TIME...

THE MOST VALUABLE THING A MAN CAN SPEND

SO said Theophrastus, over 2200 years ago. ★ ★ ★ Today our Country's rearmament program is vividly dramatizing the value of time. Our future may literally depend on such apparently small things as machining an important part of an aeroplane propeller hub in 6 minutes instead of 47 minutes.

This instance of a Bullard-created saving is not an isolated one. Equally important savings are being made daily by hundreds of Bullard Mult-Au-Matics and Bullard Vertical Turret Lathes engaged in national defense and in ordinary peace time production work.

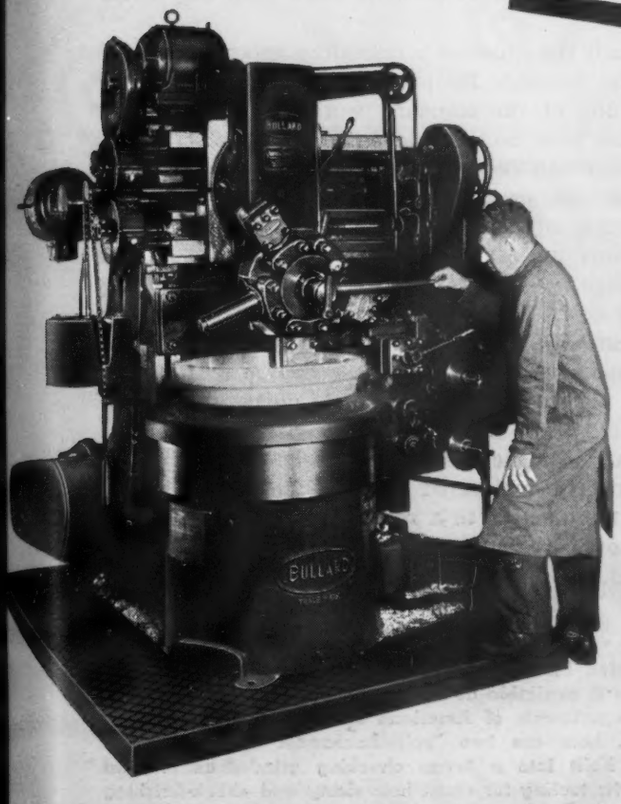
For 1941 Bullard pledges to its many customers the utmost effort to meet their needs as promptly as possible.

We will welcome any opportunity to help manufacturers increase their production in any way possible, either through the installation of new Bullard machine tools or the re-tooling of those which they may now have in use.

Old Time --- 47 Minutes

Mult-Au-Matic Time 6 Minutes

SAVED--- 41 Minutes



BULLARD Mult-Au-Matics and Bullard Vertical Turret Lathes have one vital point in common. Each is more than a machine tool — each offers methods of machining with real advantages in speed, in accuracy, and in reliability, which are not shared in by other types of tools. To thoroughly explain those advantages and their application to an individual manufacturer's problem is a task for individual study and personal discussion. Trained Bullard Engineers are at your disposal for this service.

BULLARD COMPANY BRIDGEPORT CONNECTICUT

or fancied fears that it would not be possible to buy new cars in 1941, or that extra taxes would be levied on 1941 purchases. Obviously these buyers will not be in the market this year.

4. Establishment of priorities on materials, parts and equipment, in the interest of speed for the defense program, may restrict automobile production.

5. Used cars, especially those of recent vintage and priced fairly high, are slowly filling dealers' lots. Movement of these vehicles is not yet a serious problem, but it may be by spring.

6. The belief that new car production keeps step with national income, and that national income of, say, 150 billions would imply demand for ten million cars, held in many high places in government, has been ably exploded by such analysts as John W. Scoville of Chrysler Corp.

If any or all of these six tenets are correct, then a shortage of either cars or customers is in prospect. It appears shortage of customers is more probable.

■ CARRYING forward figures on persons-per-automobile, which STEEL publishes each year at this time, indicates a slight revision for 1939 in view of the fact registrations exceeded earlier estimates, mounting to 30,615,087 and reducing the individuals per car to 4.28. Estimating another 600,000 increase for 1940 and using the official 1940 census figure of population, 131,669,275, the ratio is cut further to 4.22. Following is the tabulation since 1925:

Year	Population United States	Registration All Motor Vehicles	Ratio of Population per Vehicle
1925	115,378,000	19,937,274	5.78
1929	121,500,000	26,501,443	4.58
1932	124,822,000	24,115,129	5.17
1937	129,257,000	29,705,220	4.35
1938	130,215,000	29,485,680	4.42
1939	131,100,000	30,615,087	4.28
1940	131,669,275*	31,200,000†	4.22

* Official U. S. Census. † Estimated.

In this connection, it should be noted that registrations do not include tax-exempt official cars which have been mounting up appreciably in the New Deal years. Treasury department figures show that in 1939 there were 121,270 such cars in federal service, and state figures indicate 237,513 more in state service, a total of 394,783. Final figures for 1940 are not yet compiled, but they will approximate 425,000. Adding these, a new figure of 4.17 persons per car is obtained.

■ UNDER virtual complete dominance by the United Automobile Workers-CIO, the labor movement in the motor industry has "grown up", which is the reason deduced by some observers for the absence of any serious strikes or hold-ups to production encountered in other years since 1936. It is figured that when any industry, such as the airplane industry right now, is in process of being newly unionized, strikes, slowdowns and other difficulties always develop, but as the movement comes of age, so to speak, these disruptions are minimized, or grievances are solved before reaching the acute stage.

Under the surface, however, labor relations are far from calm. Unionists in general are a truculent lot, and if they feel like taking a day off to go hunting, then off they go with little thought to the chaotic effect their departure has on schedules and on other men's jobs.

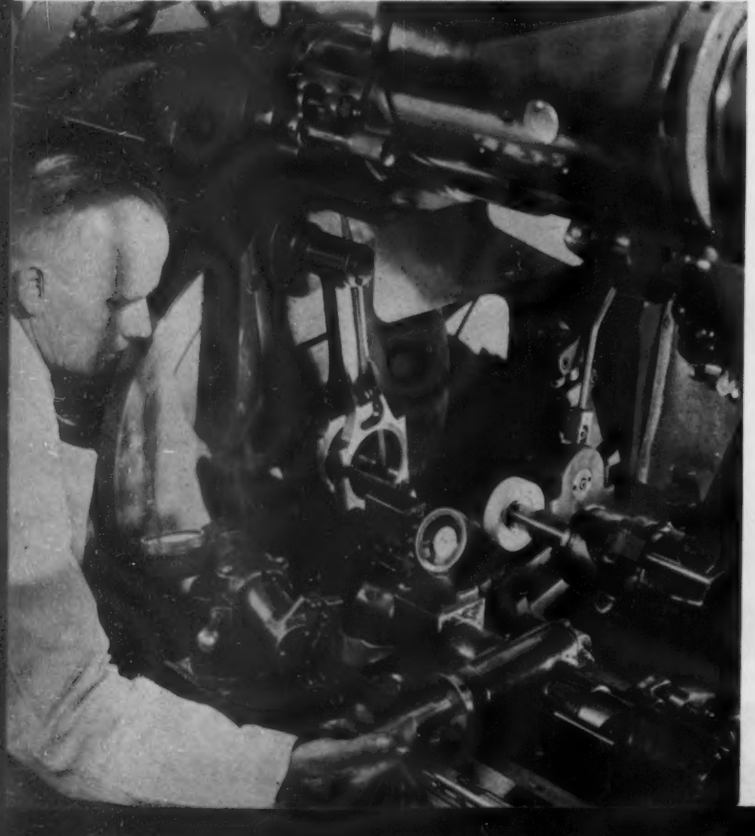
Labor in Control of Production Rate

Scant reward is possible for efficiency or exceptional skill in the ranks of automobile labor today. All workmen are leveled off to the plane of the least efficient, or somewhere near that, and co-workers make sure that no overambitious upstart will try to work faster than they see fit or to do more work than they deem necessary.

Basically the situation is unhealthy, especially today, when the demands for production are so intense. A lengthening of the standard work week beyond 40 hours has been recommended by such authorities as Alfred P. Sloan Jr., chairman of General Motors, and if the defense program appears to bog down in the near future, efforts will be made to put these recommendations into effect.

Although incentive systems are passe in the motor industry now, it seems only reasonable to expect they will return, perhaps in some different form, before many years have elapsed. If men can be sold on the idea of making more money and can be guaranteed that rates will be frozen at definitely measured levels, and if at the same time managements can be shown how properly engineered incentive systems will pay profits, the barriers to a return of the incentive idea are removed, the unions notwithstanding.

■ PRODUCT-WISE, the past year was distinguished



■ **Precision instruments, formerly limited to laboratory or tool room if available at all, are now common in manufacturing departments of American metalworking shops. For example, here are two "split-thousandth" dial indicators actually built into a Bryan chucking grinder as integral units in its tooling for exact hole-sizing and cheek-finishing of connecting rods under quantity production conditions in the new Packard marine engine plant, Detroit**

HAS YOUR DESCALING METHOD ALL THESE FEATURES?

1. No etching
2. No dimensional changes
3. Rapid and economical
4. Easy to operate
5. Descales recesses
6. Produces chemically clean surfaces
7. Long solution life
8. No health hazards
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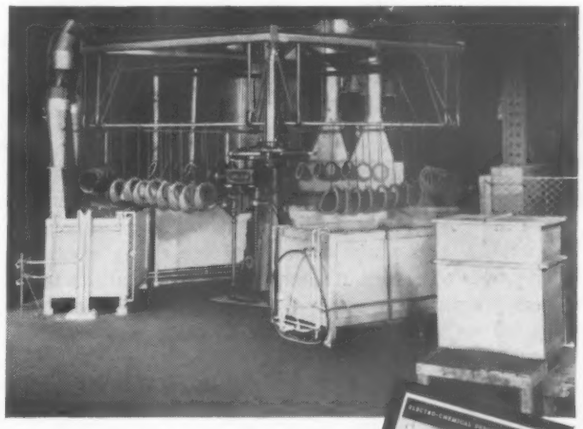
IF you are now descaling parts by a method which lacks even one of the points listed above, you should send for this booklet which describes the Bullard-Dunn Process. And, lest you think that a method of descaling which does all these things so thoroughly is likely to be complicated, cumbersome or unwieldy, take a look at the typical conveyorized Bullard-Dunn Process installation illustrated here. Fill out and mail the coupon now, so you can study the Process at your leisure.



BULLARD-DUNN *Process*

Bullard-Dunn Division of The Bullard Company, Bridgeport, Connecticut

THE BULLARD-DUNN DIVISION
The Bullard Company
Bridgeport, Conn.

Send me your booklet—right away.

Signed_____

Company_____

City_____ State_____

by emphasis on new transmission and clutch designs. Chrysler extended its fluid clutch to Dodge and De Soto, introduced a new semiautomatic transmission to go with it on De Soto and Chrysler, and made available vacuum boosters on gearshifts for Dodge and Plymouth.

Oldsmobile refined its fully automatic transmission for 1941 models, and late in the year this equipment was offered on Cadillac. Despite manufacturing difficulties, the transmission has been successful and well received by the public, suggesting its further adoption by other General Motors divisions before long.

Packard introduced an "electromatic" clutch as optional equipment, Hudson countered with a "vacumotive" drive, also optional. All of these devices, while representing mechanical advances, have introduced an element of confusion throughout the industry, resulting in some appeals for a degree of standardization in transmissions and clutches.

Nearly all builders carried out extensive body change programs. Tool and die shops in the automobile category experienced one of their most active and profitable years. Designs were in no wise radical, but emphasized streamlining and the "torpedo" styling introduced by General Motors in 1940 models.

Graham and Hupmobile have dropped from the passenger car picture, reducing the number of independent manufacturers to six, if Crosley Corp. is included.

New plants erected during the past year were numerous and with the added impetus of a dozen new plants for defense equipment manufacture, building in the Detroit area is at a furious pace. Buick completed a large new axle plant. Pontiac extended its foundry facilities. Chrysler opened its large central engineering laboratories. Nash re-outfitted its body plant for production of a new type of small car. Ford completed several new buildings, including two new "village industries."

So, as 1941 dawns, the automobile industry finds itself in a strong position after an exceptionally good year. Optimism is the rule, in witness whereof are the accompanying statements of leading figures in the industry. Shadows there are, of course, but it is reassuring to know that the dark aspects are realized and are being discounted in long range planning.

Referring to the "superficial indications of returned prosperity" which will continue as long as the "synthetic influence of the enormous amount of government spending continues," Mr. Sloan in a recent analysis concludes that "the problems which have beset industry for so many years still remain unsolved and are far too greatly unappreciated. They may be counted on to reassert their influence when the present emergency is over."

Auto Industry's Leaders See 1941 as Banner Year

"Excellent Conditions for 1941"

". . . . In general, business appears to be on the upswing and it is our feeling that we will see excellent conditions during 1941. Insofar as the defense program is concerned, we are ready and willing at all times to co-operate with the national defense commission and the President to do anything we can to help by building whatever material we can."—J. W. Frazer, president, Willys-Overland Motors Inc., Toledo, O.

Getting Ready for Better Year

". . . . From the government we have secured radio business, household refrigerator business and some automobile business. On all of these three lines we are working closely with the government, having established an office in Washington for this purpose, and we are doing everything in our power to contribute our talents and facilities to the defense program. We think 1941 will be a better year for Crosley on all of our lines, as we have set up a program to make it better. Generally, we feel that 1941 should be an excellent year from a volume standpoint unless the defense program assumes larger activities than indicated at present, which might limit the capacity for commercial home needs."—R. C. Cosgrove, vice president and general manager, Crosley Corp., Cincinnati.

Advises Preparation Now for Aftermath

". . . . We must not let the pseudo-prosperity for the moment blot out of our minds the depressing fact that our national economy was in a state of eclipse for a full decade from 1930 through 1939. There will be a progressively serious lag in business when defense activities subside and for this reason the time is appropriate for intensive efforts to compensate for that eventuality."—P. G. Hoffman, president, Studebaker Corp., South Bend, Ind., from address to Indianapolis Chamber of Commerce, Nov. 28.

"1941—Banner Year in Automobile Sales"

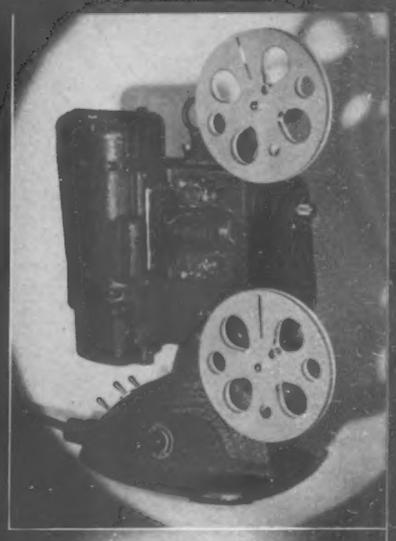
". . . . Packard was among the first to take up the responsibility of defense manufacture. We did so with the full knowledge of the challenge it entailed and the sacrifice called for. Already in production for more than a year in the manufacture of marine motors for torpedo boats, we are now engaged in preparation for the manufacture of Rolls-Royce aircraft motors. Simultaneously we have kept pace in the normal production of motor cars—necessary to the continuance of our national system of transport and business. The impact of defense billions has returned thousands of citizens to profitable, sustained employment. It is a part of our duty to supply these workers with necessary transportation. By the combination of emergency and necessity 1941 should be a banner year in the sale of new and used automobiles."—M. M. Gilman, president, Packard Motor Car Co., Detroit.

To Emphasize Aircraft Engine Parts Production

". . . . Production of parts for the 1100-horsepower Allison aircraft engine occupies an important place in Cadillac's 1941 plans. Manufacturing in this field has been expanded until it now covers such major parts as crankshafts, camshafts, connecting rod and main bearing units. Employment meantime has steadily increased, at present time 3000 of our workmen are devoting their skills to this important phase of the defense program. Fortunately, due to its high percentage of veteran craftsmen, Cadillac has been able to fill and train its aircraft parts staff without any interference with output of automobiles. I say 'fortunately'

(*Please turn to Page* 370)

DIE CASTING IS NO CURE-ALL, BUT-



Size—9⅜" x 6" x 5¼"
Weight—1 lb., 14 oz.
Wall Thickness—
Approximately 0.059"
Strength of the Alloy
40,300 lb. P. S. I. Tensile
20 ft. lbs. Impact—¼ in. sq. bar
(Both Values Determined on Test Bars)

● As with other fabricating materials and processes, ZINC Alloy Die Castings are not a cure-all for every production problem. However, numerous problems, common to many metal parts produced today, were solved when this motion picture projector frame* was die cast of ZINC Alloy.

To minimize assembling and machining costs, the projector frame was designed to be produced in one piece. This entailed a complexity of shape which could be obtained only by die casting. Also, as cast from a ZINC Alloy, the part is dimensionally accurate, insuring a snug fit in the projector assembly.

Impact strength is another important requirement, because of the abuse a motion picture projector takes in service. Impact figures, along with other pertinent data, appear on the tag attached to the casting.

The part is finished in wrinkled enamel before final assembly. The smooth as-cast surface of a ZINC Alloy Die Casting promotes ease of finish—whether an organic or electrodeposited coating is required.

If *you* are not thoroughly informed on the physical and economic advantages of ZINC Alloy Die Castings, we suggest that you consult a commercial die caster — or write to The New Jersey Zinc Company, 160 Front Street, New York City.

*Just one of a total of 16 ZINC Alloy Die Castings in the complete projector.

ZINC ALLOY DIE CASTINGS

The Research was done, the Alloys were developed, and most Die Castings are made with

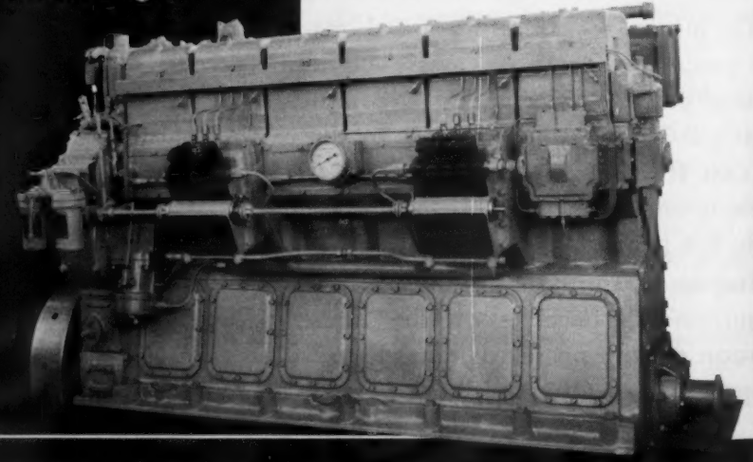
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

With a C-B Diesel for - -

SIMPLICITY • RUGGEDNESS • INSTANT CONTROL • ECONOMY • LOW MAINTENANCE • FLEXIBILITY

More and more Flexomotives are going into switching service! The fine economy of their Cooper-Bessemer Diesel Engines is already well established. Those engines and direct drive assure utmost simplicity . . . Plant managers like their instant availability . . . Low maintenance is guaranteed by their ruggedness and the locomotives' few working parts . . . Extreme ease of handling comes with one-lever control . . . and the flexibility of 340 diesel horsepower, direct-connected to the wheels, is unique.

A Flexomotive with a Cooper-Bessemer Diesel Engine is an unbeatable unit!



A Type EN Locomotive Diesel Engine as used in Plymouth Locomotive Works' "Flexomotive" . . . 340 instantly available horsepower.

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1501 Arcade Building, St. Louis, Missouri

Technical Progress Aids Defense

—Can diecastings replace other types of parts in tanks, aircraft, guns . . . . if so, how about a possible shortage of zinc?

—What type of stamping and forming is being developed to speed aircraft work?

—Is there enough steelmaking capacity?

—What are the important new alloys and where are they being used?

—How is shell and cartridge production being speeded?

—What is being done to relieve the forging bottleneck?

—Is there a top speed for continuous strip mills?

—How are machining speeds being increased?

TO GIVE you the answers to these and many other similarly important questions, STEEL went to not one, not ten, not a hundred, but to almost 600 outstanding authorities on the different phases of metals production and metalworking. The result, presented on the following 67 pages, is the most authoritative and comprehensive cross section of expert opinion ever gathered in this field. These are highlights of today's progress and today's problems—written not by reporters, not by editors, but by men actually responsible for many of the developments about which they speak—men who today are in America's first line of defense—production. While it is impossible here to list every subject covered, a few of the principal ones and the pages on which they may be found are:

Casting 225
Diecasting 230
Finishing 251
Forging 234
Handling 254
Heat Treating 246
Joining 236
Machining 272
Metallurgy 220
Refractories 223
Stamping 243
Steelmaking 262
Welding 237

—The Editors

Technical Progress Aid

New Alloy Additions Greatly Improve Low-Alloy Steels

BY JEROME STRAUSS
Vice President
Vanadium Corp. of America, New York

■ A PRIMARY steelmaking problem is how to supply in greatly increasing quantities, constructional steels of the carbon and low-alloy types possessing an exceedingly high degree of uniformity not only within each heat but in a long succession of heats of the same specification or type composition. Not only must chemical analysis be uniform but also the steel's response to heat treatment, machining, etc. Coordination of mechanical and metallurgical research is necessary to insure uniform and maximum performance of products made by mass production methods. Thus is demanded the least expensive steel that can provide the minimum requirements along with the least possible variation from acceptable minimum limits of performance. The effect on steel making has been in two directions; namely, tremendous progress in open-hearth operation, and the construction of larger and larger electric furnaces of improved design. The last year has witnessed many installations of furnaces of 25 to 50 tons capacity. Frequent announcement of other new units continues.

Recent important metallurgical developments in steelmaking include a group of alloys that increase hardenability simultaneously with improving ductility and impact resistance in the quenched and tempered state. By enhancing these properties and rendering them more uniform from heat to heat, these new alloys assist in meeting more rigid requirements. Certain steel sections are not capable of complete hardening in oil and must be hardened in water, with the attendant likelihood of distortion and cracking. By use of these new alloy additions, these same steels may be made fully hardenable and in sections larger than those heretofore hardenable throughout. The ductility in the quenched and tempered state is of distinct value in such parts as gears, springs, shafts, axles and the like. The core of carburizing steels is given higher strength or greater ductility or some suitable combination of the two. Improvements in case depth and toughness also have been observed.

Alloy Steels Prove Successful in Dies for Diecasting Both Zinc and Aluminum-Base Metals

BY H. A. PARDEE
Manager, Tool Steel Division
Crucible Steel Co. of America, New York

■ DIE steels for diecasting zinc and aluminum-base products have nearly reached the standardization stage. In zinc-base dies, a steel readily machinable and easily polished is wanted—but it must also possess wearing characteristics usually associated with a high heat-treated hardness. Fortunately, such a steel is available in the low-alloy chromium molybdenum type at a hardness of 200 or 250 brinell. While both analysis and hardness are important, structure is the one factor which conclusively determines whether the steel will make a good die. Steel with proper structure is free from large ferrite areas and takes a uniformly high polish which does not "rough up" during casting, a condition quickly mirrored in the work. Whether 200 or 250 brinell should be used rests with the diemaker. While an increase in machining time may result from use of the harder material, longer runs and greater freedom from marking and peening will result. The harder dies will be found to be cheaper on a per casting basis.

The erosive character of molten aluminum, plus the higher casting temperature, requires a die steel at a much higher hardness. Resistance to heat checking and cleavage cracks also is imperative. As a hardness of 410 to 450 brinell is necessary to meet these conditions, machining must be done in the annealed condition. Under these circumstances, the aluminum casting die must harden in air for minimum size change, be inherently nonscaling to cut down finishing time, and capable of tempering at 1100 degrees Fahr. to produce a hardness of 410 to 450 brinell. The 5 per cent chromium steel with additions of molybdenum and vanadium has shown its ability to meet these requirements so successfully as to be considered standard for the industry.

Metals Society Inspection Courses Fill Important Need

BY W. B. COLEMAN
W. B. Coleman & Co.
Philadelphia

■ DURING 1940, high-frequency induction heating, originally developed for hardening crankshaft bearing surfaces, has made impressive progress not only in the form of new, more precise equipment but in the adaptation and expansion of the process to many other parts.

Powdered metal is rapidly making progress and in that industry there are many persons working on sources of iron. It is quite likely that the foreign material will be out of the market for some time to come so various materials are being investigated to learn the possibilities of adapting the product to powder metallurgy. I can visualize rapid growth through the demand in machine tools as well as defense materials. Many small parts that have been made from drop forgings and castings will be replaced by the use of powdered metal.

In defense materials, paramount at the present, inspection has become a very serious matter. Persons unfamiliar with inspection methods have of necessity been employed on in-

id Defense

spection and we all know that there can be a liberal interpretation of specifications and results by inspection and still have an article that is serviceable for the purpose intended. Several chapters of the American Society for Metals have recognized the necessity for enlightening these embryo inspectors and have inaugurated inspection courses that have met with outstanding success, so well have they answered this important need.

List of Standard Significant Steels Now Prepared, Should Be Adopted Immediately

BY EARLE C. SMITH
Chief Metallurgist
Republic Steel Corp., Cleveland

■ ABOUT a year and a half ago, the American Iron & Steel institute started to simplify the job of the steel industry by making it possible for the users of steel to know what steels were available. The basis of availability was a list of steels regularly produced in quantities of such amount that their production was really significant. The work of classification into significant and nonsignificant volume is proceeding. A fairly complete list of steels ordered to physical properties, or chemical analysis, or by requirements of the job, has been completed. Adoption now awaits either pressure of defense or acceptance by the producers.

Concurrent with this work and entirely upon their own initiative, the agencies of the government have carried on similar work. The sample list of Ordnance department steels and the SAE list of aircraft steels are examples of the same trend of thought, indicating that customer and producer alike recognize the need. Pressure of defense needs will hasten the acceptance of this idea as a clearer understanding of the steels in current production and of the standards of quality to which these steels are produced should help in meeting defense needs.

Proceeding at the same time is the establishment by the institute of a committee of technical men to assist in working out solutions for problems which arise due to sudden need for defense steels. As rapidly as possible, the active steel specifications of government departments are being reviewed by groups of men intimately familiar and directly connected with the actual production of the commodities involved. Comments are made available so that revision of the specifications can reflect the latest standards of production.

The better insight into the problem of production of defense material reflects the patient work of the many ordnance offices during the years when education was all that could be discussed. Industry owes a debt and should be grateful to those officers who so patiently forced the knowledge upon us during a period when our distractions were many and our vision too clouded. Our repayment will be prompt and our co-operation the kind which the emergency requires.

Plastics, Light Metals Seen As Serious Competition For Steel in Future

BY A. ALLAN BATES
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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■ A MOST notable aspect of metallurgical developments is the conclusion that newly intensified competition for markets will result—not necessarily during the present period of armament activity but rather after the inevitable ending of that activity within the next several years. Predictions that aerial transport arising out of military demand will reach 25 to 40 times the present magnitude have been made on good authority. Thus stimulated, engineering materials competitive with steel are being encouraged toward a growth many times greater than that of the steel industry. Production capacities of aluminum and magnesium particularly are to be increased enormously. Also nonmetallic materials, especially "plastics," are being expanded both in tonnage produced and range of application. It seems safe to predict that by 1943 both plasticized materials and light metals will have attained production rates so greatly in excess of present rates that steel tonnage by comparison will appear to have stood still. This is not to say that there will not be some increase in steel capacity, particularly in the electric furnace steels suitable for exacting applications in munitions; but reliable evidence points to the fact that, on the whole, no great increase in steel capacity will be required to meet national defense demands. When this flurry of armaments ends, the steel industry will face competition of a magnitude and aggressiveness never before encountered. The steel industry should anticipate this crisis and start an integrated and concerted program of research to develop new applications.

Incomparably, the most hopeful field is housing. Individual steel companies have already made sporadic attempts to study housing. These, however, have not been well sustained or whole-heartedly supported by the industry. The sum total of these efforts have been discouragement rather than progress of the order which is going to be required. Probably nothing will suffice short of a major program backed by the entire steel industry in collaboration with other related and complementary industries. This program will be costly and slow and must involve not only technical research but also a heavy gamble in liberal public education.

Defense Effort Puts Emphasis On Automatic Heat Treating

BY R. L. DOWDELL
Professor of Metallography
University of Minnesota, Minneapolis

■ AN IMPORTANT problem at present is how to give men enough metallurgy and metallography to help industry with processing and inspection of metals. The extreme interest shown by metallurgical and other engineers in the latest phases of metallurgy is reflected by the largest attendance ever at the 1940 Metal Congress in Cleveland. That all metallurgists are getting behind our defense problems with everything they have was well reflected, especially by attendance at the ordnance and welding sessions.

Commercial heat-treating practice is well under control

in our leading concerns with excellent equipment now in use. It is quite a revelation to see working in industry these modern gadgets which only a short time ago were new developments being described in technical papers. More automatic heat-treating equipment is in sight and will result in greater precision with lowered costs. There is little doubt the defense effort will aid development of more and better equipment.

Cold-Reduction Process Now Is Used for More Types of Work

BY ANSON HAYES
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American Rolling Mill Co., Middletown, O.

■ DURING 1940, there was a continued trend to the cold-reduction process for the manufacturing of various types of sheets. High-speed cold reduction of light-gage material for tin plate has been supplemented by the similar cold rolling of black sheets for spelter coating and for ternes. An outstanding use of cold-reduced coils for spelter coating has been in connection with zinc-coated sheets and strips for severe fabricating and drawing requirements without coating failures or peeling taking place. This product is being used in a wide variety of articles formerly made from uncoated sheets and spelter coated after fabrication.

Additional progress has been made in developing sheets of super drawing quality for manufacturing such extremely difficult items as the front fenders for 1941 cars which have the headlamp shells redrawn into the nose. These super quality drawing sheets, manufactured on a killed steel basis, are permanently free from stretcher strains and strain aging and possess superior mechanical properties. Until comparatively recently, this product was considered impractical for high-finish purposes. Sheets made on a killed steel base also are finding application on other types of severe draws for which the rimming steel quality has not been entirely satisfactory.

High finish steel in coils suitable for use in progressive blanking and drawing work also is proceeding at a rapid pace. In the low-alloy content high-tensile steel field, there is an expanding demand for sheets and plates for lightweight construction purposes.

Tool and Die Steels Come A Long Way From Pre-War 1914

BY A. J. SCHEID JR.
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■ THE present status of tool steels and their significance can best be visualized by looking back to the World war, 1914-18. High-speed steel had been developed 10 years before the last war but its adoption was slow. Because of demands for increased production during that period, high-speed steel was adopted on an undreamed-of scale. Since that time many important variations in composition have been made —including the tungsten and new molybdenum types. These plus improved control of temperature, time and operating variables in manufacture have resulted in a product of new high standards superior to the high-speed steel of prior years and beyond all comparison with material of prior war days.

During the last war the relatively few die steels available were usually crudely designated as "water hardening" or "oil hardening" and hardening equipment was inadequate. Today high-carbon high-chromium super die steels and the so-called nondeforming steels, both oil and air hardening, are capable of a life far beyond steels of that time. In addition, they retain a high degree of dimensional accuracy so important for today's demands. Recent metallurgical advances in melting control result in steels of a high degree of cleanness, uniformity of composition and ability to harden uniformly from heat to heat. Increased machinability, closer size tolerances and surface decarburization control have contributed to betterment of the product. Hot etch and hardenability testing have become routine. Magnaflux inspection insures bars free from all ordinary surface defects. These and many other improvements contribute to increased die and tool life with its corresponding effect on production. With an intense rearmament program ahead of us, tool steels can be expected to establish new high records for performance and do many things formerly regarded as impossible.

Lead-Bearing Steel Machining Speeds Important in Defense

BY DR. OSCAR E. HARDER
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■ DEVELOPMENTS by Inland Steel Co. of lead-bearing steels of improved machinability during work sponsored at Battelle Memorial Institute have been described in technical literature. There are, however, certain features which characterize the lead-bearing steels of improved machinability which may be of special interest. The most unique features of improving the machinability of steels by the addition of lead are that the improved machinability can be effected without loss in mechanical properties such as strength, elongation, reduction of area, impact resistance and fatigue endurance, and without change in hardenability characteristics. Research has shown that the above statement holds for plain carbon and alloy steels.

The production of lead-bearing steel was limited to about 10,000 net tons in 1938. By 1939, total production in this country had reached 60,000 tons while 1940 output probably will exceed 100,000 tons.

From the national defense point of view, lead-bearing steels are unique in offering the improved machinability in shells which require certain mechanical properties for bursting characteristics because lead can be used to improve the machinability without changing the mechanical properties. There is another advantage of lead-bearing steels in that the addition of lead is generally additive over the effect of other elements which are used to improve machinability, such as sulfur, increased phosphorus, etc. Depending upon the particular application and machine setup, increased machining speeds range from 10 to over 100 per cent. Tool life also is increased. To get maximum returns from the lead-bearing steels, however, it is necessary to have machines which will run at high speeds and high feeds.

Better Refractories Are Vital Elements for Proper Functioning of New Control Systems

BY R. KIRKPATRICK
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■ WITH about 90 per cent of the metals industries involved directly or indirectly in the defense program, there are two outstanding places where refractories are exceptionally important. The first, efficient metal melting, is vital because of the increased demands for greater outputs at more rapid rates. Melting problems involve a need for improved refractory linings and vastly improved technique in their application. The second, refined temperature con-

trol of both melting and heat-treating furnaces, finds improved refractories necessary as vital parts of the temperature control system.

Actually the trend today is toward improved refractory linings for metal melting and for heat treating. Electric furnace products are proving more reliable. Materials like electrically fused alumina, electrically fused magnesia and combinations of these are being employed with greatly improved results.

Improved temperature control systems in sight find refractories an important factor in their success. Recording temperatures within a molten mass of metal appear possible provided sufficiently resistant refractories can be developed to withstand the shock incident to immersion in the liquid metal. Greater control of temperatures in heat-treating furnaces seems assured of success through the development of silicon carbide sighting tubes which can be so located in different parts of a single furnace that temperatures can generally be observed. This tends to remove the element of luck in temperature control and reduces uniform heating to an established fact.

Insulating Refractories and Light-Weight Metal-Supported Construction Are Used More

BY S. M. JENKINS
Building Materials Division
Armstrong Cork Co., New York

■ MODERN insulating refractories are helping to give the defense program the most modern and fastest production units ever devised. These materials have been used long enough and in various types of equipment to have proved themselves beyond all question. An important development is the extensive use of alloy steel castings in light-weight hanging walls and flat arches built of insulating firebrick.

From the constructions used and the different types of heat problems involved, we feel the greatest development in handling heat in furnaces, ovens, sections of boilers, oil cracking furnaces, waste heat ducts, breeching linings, and so on, will be by the greater use of light-weight insulating-refractory hanging walls and flat arches. The light-weight walls when used as panel construction all have outside steel shells. This increased use of steel in such walls means added strength and air-tightness. Since these light-weight materials have become available in all sizes and shapes, their use as lining material for towers and large processing vessels of steel has increased greatly.

New Refractory Cements Found To Prolong Life of Settings

BY C. E. BALES
Vice President
Ironton Fire Brick Co., Ironton, O.

■ DURING the past year, the refractories industry has continued research and development work on an enlarged scale. More careful selection of raw materials now makes available clay fire brick of higher refractoriness, greater resistance to spalling and slag erosion than ever before. These refractories are proving to be more reliable in open hearth checkers, soaking pit covers and for billet heating furnaces. De-aired hand made shapes are being largely used in lining hot metal mixer ladles. Too, considerable progress has been made in manufacturing more reliable cupola blocks for continuous pouring service.

With increased use of fused soda ash for desulphurizing molten iron, many foundries now use U-shaped ladles lined with a high quality, specially prepared plastic, ramming refractory. Blast furnace iron may also be desulphurized in the future, and work is now in progress on a suitable refractory for these large ladles.

Many refractory cements are now made from kyanite, diaspore and other highly refractory materials and their use is actually prolonging the life of the brick setting. Committee C-8 of American Society of Testing Materials has been active in developing better test methods as well as specifications for refractories. At present an effort is being made to develop a suitable slag test, urgently needed for many years.

Basic Roof Brick Sections Are Successful in Several Plants

BY GILBERT SOLER
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Timken Roller Bearing Co., Canton, O.

■ ALL refractories are being subjected to severe service conditions by efforts of open-hearth operators to increase tonnage outputs and to use higher temperatures during the "melting down" period. Basic roof brick sections of both the sprung and suspended-arch type construction have been tried successfully in several plants. It appears that any complete basic roofs contemplated for future construction will be of the suspended-arch type. The use of plastic basic ramming materials for open-hearth and electric-furnace bottoms has resulted in reduced "burning in" time as well as providing better hearth contours. A very recent bottom refractory which has not been placed on the market as yet has been described by P. M. Reinartz of the American Rolling Co.

During the last war the United States was dependent to a large extent on foreign sources for ores and minerals used in the production of basic refractories. However, good grades of domestic deposits have been made available in the last decade including: Magnesites in Washington and California, brucite in Nevada, chemically precipitated magnesia from sea water bitterns in California, dolomites from Ohio and Pennsylvania, and olivine deposits in North Carolina. Producers of refractories have stock piles of chrome ore on hand and lower grade domestic ores are available in reserve.

Chrome-Magnesite Brick Finds Increased Open-Hearth Use

BY FRED A. HARVEY
Director of Research
Harbison-Walker Refractories Co., Pittsburgh

■ ONE OF THE most distinctive trends of the year has been the increasing use of magnesite and chrome brick in open-hearth steel furnaces. Chrome-magnesite brick, both unfired and fired, are replacing silica in front and back walls and in bulkheads. Metal-incased magnesite brick have been installed as shoulders 2 to 3 feet wide in many open-hearth roofs with considerable success. The shoulders extend from 30 to 40 feet in length and from 2 to 3 feet up from the skewback over the tap hole. There is a general feeling that the use of all-basic roofs for open-hearth furnaces may not be far off. Manufacturers feel they have sufficient knowledge of changes needed in construction and type of brick.

A development of considerable interest is the Agnew design for blast furnace lining brick. Brick are skewed in two directions so all unbroken joints in a vertical direction and half of those in a horizontal direction are eliminated. The lining is tighter and structurally stronger than

the conventional design, while the reduction of the number of straight continuous joints retards slag and gas penetration.

Another recent development of importance is the Smalley checker design using a high percentage of standard brick sizes with the mass of brickwork larger than usual. Ease of lancing and clean checkers are advantages. In contrast with the condition during the first World war, the stoppage of European magnesite has resulted in neither a shortage nor change in quality of American refractory brick or grains.

Better Process Control Gives Refractories Longer Life and More Resistance To Slagging

BY L. C. HEWITT
Director of Research
Laclede-Christy Clay Products Co., St. Louis

■ THE year 1940 witnessed a large expenditure by the refractories industry in plant modernization, particularly for additional process control and product betterment. One outcome is the tendency to increase the density of first quality, super-duty and high-alumina types of brick without sacrifice of spalling resistance, thus giving better resistance to slagging and greater thermal capacity, particularly important in checkers.

A noted improvement also has been made in bung and side wall brick for malleable furnaces. Bung brick, possessing both high strength and resistance to thermal shock, are now available. Increased life results from their greater ability to withstand mechanical abuse and slag action. Side wall brick, likewise, are denser than heretofore. Still further improvement may be expected. What has been said about malleable side wall brick also applies to cupola block. Block of still lower porosity, more uniform structure and increased resistance to temperature change is likely.

A new type of bonding material is finding increased use as its resistance to slag and metal attack is rather remarkable. When used in bonding malleable side wall brick, the joints protrude rather than recess. Side wall life is further increased by repairing the metal line with a mixture of the bonding material and ground brick. Other applications include any type of heating or melting furnace where high temperatures and slag action are present. The product is heat rather than air setting—an important advantage.

Malleable Castings to be Used Widely in Equipment for Defense

BY ENRIQUE TOUCEDA
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■ IN THE manufacture of malleable iron castings, there has been a constant improvement in work's practice technique, particularly in heat treating where special annealing cycles have been developed to increase substantially the toughness of the product without any sacrifice of ductility. Possibly a large tonnage of malleable iron will be used in the defense program for parts for trucks, scout cars and ambulances, particularly as almost all will be 4-wheel drive. An auto company already has started work on an army order for 21,500 "streamlined" trucks equipped with built-in brush guards and black-out lighting systems, at a production of 200 daily.

Malleable parts in truck and automobile construction include differential carriers, cases, bearing caps, steering gear housings, spring hangers, spring seats and shackles, etc. Gear cases will be ordered in quantities of 2000 and weigh approximately 2 pounds each; hoops in quantities of 500, weighing 100 pounds each. Samples of 75-millimeter shells and 60-millimeter mortar shells are to be submitted to the Ordnance department to be tested. Castings also will be required for gun cradles and mortar mounts.

Continuing the practice of many years, tensile test bars are sent by the various plants to the consulting engineer of the Malleable Founders' society, Cleveland, so his reports may keep executives posted as to the quality of product being turned out. Average tensile test bar results for the past year show: Average ultimate strength, 54,500 pounds per square inch; average yield point, 35,300 pounds per square inch; elongation, 18.00 per cent in 2 inches. As a matter of interest compare the above with the average tensile properties of seven plants running on the ASTM Specification No. 35018: Average ultimate strength, 56,480 pounds per square inch; average yield point, 37,340 pounds per square inch; average elongation, 23.00 per cent in 2 inches. Several plants are making an alloy malleable iron product, the average tensile properties of which exceed considerably those of the product made in accordance with the higher specification.

It is possible that in the near future there may be a substantial demand by the Ordnance department for pearlitic malleable castings for shells. While tests are now being made, nothing definite will be known regarding the results for some time to come.

Many Important New Refractory Materials Now Under Test

BY H. M. KRANER
Ceramic Engineer
Bethlehem Steel Co., Bethlehem, Pa.

■ AT THE present time there is a crying need for longer campaigns to minimize furnace delays, especially in blast-furnace and open-hearth operations. Recent studies have shown that modern blast furnace linings, although superior to the linings of yesterday, are wearing out the same way. Refractories men are promoting several improvements in clay refractories to reduce the effects of disintegration by carbon deposition and alkali attack.

Use of unfired basic bricks is growing. Inverted arch bottoms have been installed in open hearth furnaces in appreciable numbers and many have been in operation for a sufficiently long time that their merits will be determined in the near future. Granular materials for open-hearth and electric-furnace bottom fettling have undergone intensive studies by mineralogical chemists to "balance" the composition, to combine the silica with lime in the proper proportion, to stabilize the resulting dicalcium silicate, to prevent migration of sodium silicate low-temperature bonds, and to provide proper bonds. The chemistry and mineralogy of these materials are now better understood than ever before. Magnesites from brucite, sea water and concentrated dolomites have established themselves. The Krespi principle of producing furnace bottoms of hard single-burned dolomite is being tried in a preliminary way in this country.

Development of Balanced 18-8 Stainless Steel Is An Important Metallurgical Achievement

BY TECHNICAL STAFF
Electro Metallurgical Co., New York

■ THERE have been several notable advances in metallurgy during the past year. It is difficult to pick out a single one from these, but outstanding in the field of aljloy steels is the development of a heat treating procedure for 18-8 cold-worked chromium-nickel ausenitic steels. It pro-

duces a substantial and uniform improvement in elastic properties and enhances their suitability for structural use where strength together with light weight is important. This treatment consists in heating the steel for a suitable period at a temperature below 600 degrees Fahr. and then air cooling. While usual low-temperature heat treatments that improve tensile properties result in lowered ductility, this new treatment which improves elastic properties does not lower tensile strength or impair ductility, impact toughness or corrosion resistance.

Proper balancing of the composition of chromium-nickel austenitic steels containing molybdenum and columbium or titanium to avoid impairment of physical properties or corrosion-resisting characteristics also has been achieved during the past year. Molybdenum added to stainless improved corrosion resistance. Columbium or titanium is added to this type of steel primarily to eliminate susceptibility to intergranular attack. It would appear that addition of both alloys would combine both these desired characteristics. However, addition of these ferrite-forming elements gives a structure so unstable that the maximum benefits of each element are not obtained. Proper balancing of these elements to produce a stable structure with optimum physical properties and corrosion resistance as now achieved is a notable metallurgical contribution.

Gamma Rays to Check Castings Help Obtain Sounder Product

BY CHARLES HOEHN
Enterprise Foundry Co.
San Francisco

■ THE most important problem right now is how to get better castings in greater volume. The trend is to more intense study of scientific methods, especially by the younger men in the industry. Gamma-ray examination of castings has done more to take guesswork out of making castings than anything else developed in recent years. The importance of progressive solidification is better understood and is now basic in the production of more perfect castings.

Late additions of silicon to cast iron are responsible for greatly improved control in the production of iron castings containing high percentages of steel scrap together with alloy additions. Castings so treated have an evenness of structure which is highly desirable and can be held within close limitations as to specifications. Heat treatment and normalizing of both iron and steel castings make it possible today to machine castings to minute tolerances without serious danger of change of shape after machining. Too, the importance of sand control, selection and preparation is more widely understood and appreciated than at any time in foundry history.

Sees Continued Advance in Almost All Phases of Gray Iron Casting

BY GARNET P. PHILLIPS
Chief Metallurgist, Automotive Foundry Div.
International Harvester Co., Chicago

■ IN THE gray iron casting industry, the past year has seen gradual and continued improvement in practically all phases. All operations involved in cupola melting are being studied for better control and lower costs. Better equipment for weighing metal and fuel, increasing use of blast control equipment, mechanical charging improvement and study of the benefits of control of moisture in the blast used—all received attention. Increased use of special irons resulted in further use of electric furnace melting and duplexing.

Important phases receiving increased attention include: molding sands; sand testing equipment for determination and control of moisture, permeability strength, flowability, refractoriness, etc.; core mixtures, baking and core properties, simplification of mixtures and evaluation of ingredients. Core blowing was further extended with better core quality and lower costs resulting. Annealing for increased machinability is being used more extensively on castings that are to be hardened. Heat treatments for hardening, in all the various fields—oil quenching and drawing, flame hardening of suitable irons and castings, hot quenching, induction hardening, etc., were the object of much research and study.

New Pearlitic Malleable Irons Greatly Expand Castings Field

BY L. N. SHANNON
President
American Foundrymen's Assn., Chicago

■ THIS year finds the foundry industry in an excellent position to aid greatly in the defense program. In cast iron, 50,000 to 60,000 pounds per square inch strength is being obtained consistently by carbon control, heat treatment and alloy use. The pearlitic malleables with tensile strength of 80,000 to 100,000 pounds per square inch and yield points of 50,000 to 60,000 pounds per square inch have opened new fields of application. In the steel casting and nonferrous field, the development of new properties and applications have been equally startling. In the steel casting field, the use of the converter is making an interesting comeback because of recently acquired knowledge of desulfurizing and mechanical control of the conversion process through the use of the photo electric cell, focused on the flame. Through use of alloys and heat treatment, steel castings are now available for practically any engineering requirements.

Equipment and methods for quantity production have more than kept pace with the developments in engineering properties as was shown so extensively at the May 1940 Chicago exhibit of the American Foundrymen's association which brought together the largest gathering of foundrymen ever assembled. Through the work of the association, engineers are made aware of the possibilities of castings in engineering design as indicated by the publication this past year of the second edition of the Cast Metals handbook.

Foundries Already at Work To Meet Requirements of Defense

BY P. J. POTTER
Vice President
Pangborn Corp., Hagerstown, Md.

■ THE year 1940, especially the latter half, has seen foundries and foundry equipment manufacturers getting ready to meet needs of the defense program. Already steel foundries are starting production on cast steel turrets and armor for tanks, armor for military trucks and light gun shields and mounts, shells and ship castings. Nonferrous foundries are getting into mass production of castings for rotary airplane motors. Large aluminum castings for the Rolls Royce airplane motor will need some of the largest size molding machines in this country.

Malleable and gray-iron foundries are stepping up production as fast as requirements are received. The largest and best equipped foundry in the country exclusively for machine tool castings, started last month, should materially help machine tool manufacturers. The trend toward mechanization of all operations continues with keen interest in larger and special types of molding machines, sand con-

ditioning units, blast cleaning equipment, conveyors and cranes. With the necessity of less and less heavy manual lifting and improved ventilation, lighting, sanitary conditions, etc., the foundries offer such excellent working conditions that high-class labor is attracted and kept.

Steel Foundries Expand Use of Nondestructive Testing

BY CHARLES W. BRIGGS
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Steel Founders' Society of America,
Cleveland

■ ONE OF the most interesting developments in the steel casting industry, particularly in the light of the country's rearmament program, is the extensive use of nondestructive testing methods. A large number of foundries are equipped to carry on nondestructive inspection, and many foundries doing government work have made nondestructive testing a part of their daily routine. A considerable number of steel foundries are using gamma rays for inspection and to study casting technique. Radium is more popular than X-rays as an energy source.

The Navy has recently advised that radiographic examination was being extended to all steel castings for main propulsion turbine castings, main steam chests, main steam line fittings and main steam valves as well as principal ship castings including stems, stern posts, struts, rudder castings, stern tubes, turret roller path castings and others.

A number of steel foundries have qualified or are qualifying under the ballistic test requirements of both the navy and the army for armor plate castings. Some armor plate castings orders are being filled. Experimental orders on the casting of shells are also being undertaken.

Steel Founders' Society of America just completed a sound slide-film on "The Designing of Steel Castings," and a Steel Castings handbook. The film illustrates many ordinary and special design problems, while the handbook presents considerable information on the mechanical and physical properties, the manufacture, heat treatment, design and uses of carbon and alloy cast steels.

Cast Steel Armorplate Is Outstanding Development

BY JOHN HOWE HALL
228 West Willow Grove Avenue
Philadelphia, Pa.

■ THE STEADY and insistent demand for thoroughly sound steel castings, coupled with increasing use of radiographic examination, has resulted in greatly increased knowledge of steel casting defects and the best means of preventing them. Design features that make it difficult to obtain sound castings are being eliminated through better understanding of the subject on the part of designers. The foundryman, at the same time, realizing that much of his product in the past has been less sound than he supposed, has improved his practice. Not the least of these is the realization that much metal has to be added to castings at various places and machined off or otherwise removed if the job is to be thoroughly sound at vital points.

The tendency to combine steel castings and rolled or forged parts by welding, has been accentuated by a wider understanding of the difficulties in securing sound castings of complicated shape with widely varying sections. In such castings of large area and varying sections, complicated by many intersecting members, it is hoped that this tendency to call in the welder to assist the foundryman will increase.

The development of methods and equipment for manufacturing cast steel armorplate for mobile equipment has been one of the outstanding accomplishments of the industry during the year.

Partially Graphitized Steels Find Greater Application

BY H. A. SCHWARTZ
Manager of Research
National Malleable & Steel Castings Co.
Cleveland

■ IF I am to pick out a single item from the year's developments, it is perhaps the progress made in the use of graphitizable steels. These are materials having a carbon content intermediate between malleable iron and high-carbon cast steels and are capable of graphitization. They seem to have found their greatest application when only partially graphitized. Very commonly they seem to find favor when containing additional alloying elements.

These materials combine great tensile strengths and ease of machining with adequate though not high ductility.

Predicts 1941 Malleable Iron Output Will Be Up 25 Per Cent

BY F. O. PARKER
Sales Manager
Acme Steel & Malleable Iron Works,
Buffalo, N. Y.

■ IT IS my opinion the malleable industry during 1940 will probably show some 25 per cent increase over 1939 as far as shipments are concerned. The industry has steadily improved during the past few years and 1940 was no exception in regard to foundry technique, soundness of castings and new improved methods of inspection.

The entire industry realizes the importance of maintaining these improvements with the influx of business which the whole industry is experiencing at this time. Improved annealing ovens and mechanical equipment have enabled the malleable foundries to look after the increased business, and give even better deliveries than were possible some years ago.

Applying Hot Blast to Cupola Seen to Offer Great Promise

BY W. R. BEAN
Vice President, Equipment Division
Whiting Corp., Harvey, Ill.

■ INCREASED use of the bessemer converter in the production of steel castings is one example of extended applications that highlight 1940. This advance is of particular significance since the converter which produces heats of relatively small quantity, 1 ton to 2½ tons delivered at short intervals, makes it possible to supply metal continuously to mold-conveyor lines, using the electric furnace as a holding unit. Too, the application of the electric eye for control of "blow" in the bessemer converter, constitutes a definite advance in this process. It is only within the past few years that low carbon steel has been supplied to mold conveyors operating continuously for eight hours or more per day.

Hydroblast cleaning of large castings in room type equipment has made real progress and the Hydroblast barrel method of cleaning brass and some other types of cast-

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President
Revere Copper and Brass Incorporated

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ings is showing much promise. Sand reclamation in conjunction with such cleaning results in substantial savings in cost of sand per ton of castings, the procedure lending itself to thorough washing and classification of grain. Extending the application of hot blast to cupola melting has resulted in substantial savings and improvement in metallurgical practice. This offers one of the most promising fields of advance in the foundry industry.

Improved Gray Iron Castings Mean Other Production Facilities Can Be Released for Defense

BY A. C. DENISON
President
Fulton Foundry & Machine Co. Inc., Cleveland

■ IT TAKES an emergency such as the present defense program to bring out the significance of the progress already made. Furthermore, when progress starts it goes forward for a time at increasing speed. Such accelerated progress in gray iron technology is evidenced by the heavy demand these past few years for improved foundry equipment of all kinds including sand conditioning, material handling and control equipment as well as better facilities for laboratory and testing work, casting cleaning, etc.

Then, too, progress is evidenced by the growing alertness of foundry management to the scientific approach evidenced by larger and larger attendance at technical sessions. All this leads to the manufacture of gray iron castings on a more scientific and economical basis. The significance of this new scientific approach to the manufacture of gray iron is that new high-standard processed and alloy irons are available today on a dependable basis that greatly expands the availability of good metals for much defense equipment. These irons can justly be added to the list of strong and special purpose ferrous metals. So many parts for which gray irons would have been unsuited in the past, today are made of gray iron to control specifications to give a very satisfactory and often superior material.

This all resolves itself in a possible enlarged service of gray iron foundries to the national defense effort both by directly supplying dependable castings of new possibilities and by releasing manufacturing capacity for other important uses.

New Cupola Design Gives Better Control, Melting Efficiency

BY OLIVER SMALLEY
President
Meehanite Metal Corp., Pittsburgh

■ DEVELOPMENTS in the foundry industry, as related to war conditions, production and new uses for castings, have been very rapid since start of the war in Europe. It is particularly important that those responsible for progress in the national defense program, especially with respect to materials, recognize the part which the foundry industry can play in contributing to the effort. Typical of what is being done in foundries is the development of a new principle in cupola design which provides a furnace that melts metal under truly scientific principles and permits: The manufacture of refined irons to chemical and physical control limits hitherto considered impracticable; higher melting temperatures with minimum gas absorption; more rapid melting with reduced fuel consumption and a lower furnace upkeep.

Castings today contributing to defense work include: The machine tool industry; shell forging and nosing dies and tools; drawing dies for all purposes; gear wheels and their extended application to the general engineering industry, permitting longer life and less noise; diesel engine and shipbuilding construction; bomb and shell castings. Torch hardening the surface of castings has seen such rapid growth that today it is not only in common use in almost every phase of engineering construction but is being applied successfully to roll manufacture, replacing the old type of chilled iron roll.

The casting industry as a whole has been and still is working for closer tolerances, higher physicals, absolute freedom from flaws and greater dependability of product. The trend was well established before the present defense effort, and care must be taken now to prevent the rush of circumstances from resulting in a sacrifice of quality.

Higher Quality of Castings Is Expanding Their Applications

BY F. A. MELMOTH
Detroit Steel Casting Co.
Detroit

■ INTEGRITY of castings has been the watchword throughout the steel castings industry in 1940. Manufacturing methods based upon careful investigation and greater use of all control practices have brought closer realization of the unexcelled potentialities of steel castings. Further extension of heat treatment has occurred—particularly quenching followed by suitable tempering, and differential heat treatment calculated to fit castings into definite new spheres of performance. Flame hardening surfaces in the presence of a suitable chemical composition also has opened up numerous new avenues for successful application of this method.

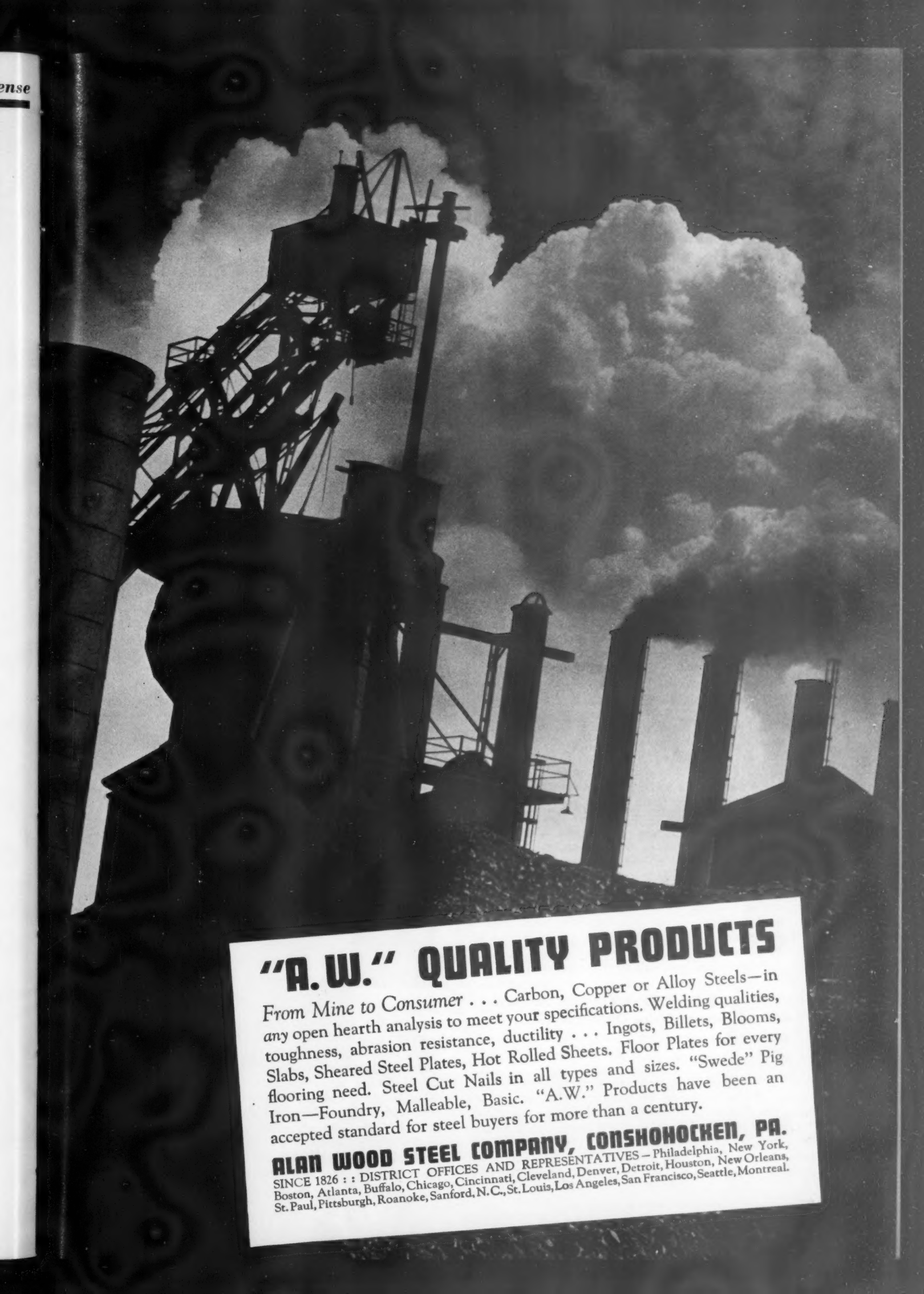
Gamma and X-ray examinations have widened in their use from the viewpoint of assistance in manufacturing control, and the certainty of internal soundness. The magnaflux type of defect detection also has seen greater application to steel castings. These developments show that foundries themselves are energetically utilizing all possible technical advances and working with users to rapidly enable the use of castings in a constantly increasing degree.

Better steelmaking, controlled mold materials, scientific and adequate heat treatment and common sense design will progressively combine to still further increase the application of steel castings. Times such as the present add emphasis to the necessity of making it possible for each and every industry to carry its full share of the work involved. The year 1940 also has seen a new edition of the Cast Metals handbook and the first edition of the Steel Castings handbook. These two books represent a veritable encyclopedia of information.

Aluminum Industry Expands to Meet Aircraft Requirements

BY E. H. DIX JR.
Chief Metallurgist, Aluminum Research Laboratories, Aluminum Company of America, Pittsburgh

■ THE ALUMINUM industry, faced with steadily increasing demands during the past several years, has recognized that greater production must be provided for aircraft expansion. As a result, the Aluminum Co. of America has additional reduction works under construction or already completed to more than double its output by July 1942. Also Reynolds Metals Co. is constructing a new reduc-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tion works in Sheffield, Ala., expected to be in full production by July 1941. Three new power dams are being constructed by the Aluminum Co. to insure an adequate power supply. New sheet mills at Alcoa, Tenn.; Edgewater, N. J.; and New Kensington, Pa., with additional extrusion equipment at Lafayette, Ind., and Los Angeles and new forging hammers in Cleveland and Los Angeles will supplement the added reduction facilities.

The increased volume of business from its research and development work has enabled the Aluminum Co. to reduce the price of new metal three times in the past year to the present all-time low of 17 cents a pound.

Development of new alloys has continued to be the most important phase of research work. Aluminum alloy bearings have perhaps been the most novel development of the past year. While yet in an experimental stage, results are very encouraging. The bearings, of single-layer construction, have proved highly resistant to fatigue and corrosion and have performed well on hardened steel shafts under high bearing pressures in bus and truck motors. Furnace, dip and torch brazing of aluminum alloys has been improved and several important commercial applications have attained production success, notably the assembly of outboard motor gasoline tanks and of refrigerator evaporator units.

Diecasting Replaces Stamping —May Help Defense Work

BY MARC STERN
Superintendent, Die Cast Division
AC Spark Plug Division
General Motors Corp., Flint, Mich.

■ BECAUSE of a more careful analysis of the intangible elements of costs, diecastings today are finding increasing application in what normally was considered to be the domain of steel stampings. While a large stamping that requires several operations may appear cheaper than a diecasting, such savings can soon be dissipated by expenses difficult to allocate. Repeated handling, for example, often means more floor space, more trucking and more chances for damaging stock, besides scrap losses are more salvageable from diecast material. Variations in stampings, either due to spring in the stock or perhaps subsequent welding operations, are reflected in increased assembly costs.

This viewpoint is best exemplified by the fact that a mass production automobile in the low-price field adopted, for the first time, a diecast radiator grille on its 1940 model, involving a consumption of over 3,250,000 pounds of zinc alloy. Such progress is made possible largely by improvements in diecasting machines. The versatility of a diecasting machine is a real asset in these days of machine tool shortage for it can do in one operation, what usually requires several machine tools to do. Too, instead of using rolled stock which again involves tooling, it starts with the primary raw materials from the smelters.

Diecasting To Relieve Bottleneck from Shortage Of Screw Machines; Helps Other Facilities, Too

BY CHARLES PACK
President
Doehler Die Casting Co., Toledo, O.

■ WITH emphasis strongly on defense materials, the diecasting process is ready to assume its position as an "emergency" process. Already hundreds of parts are being diecast for various branches of the government service. On one airplane alone, there are more than 150 diecast parts in aluminum and magnesium-base alloys. Other parts are being diecast for gas masks, fuse mechanisms, trench mortar shells, magnetos, batteries and many more.

But the most important function of the diecasting process is to supplement other methods of manufacture. To illustrate: With the defense program hardly under way, there is already a shortage of screw machines. By the diecasting process most screw machine parts can be produced directly from molten metal, thus eliminating this "bottleneck" in screw machines as well as the need for wrought bars, also relieving facilities for producing wrought metals. As the defense program gets into full swing, it may be expected that all available diecasting facilities will be utilized to supplement the screw machine for the production of aluminum, magnesium and brass parts.

Cold-Chamber Machines Help Aircraft Diecasting Work

BY HERBERT CHASE
Consultant
31 Fife Street, Forest Hills, N. Y.

■ ZINC alloys continue to dominate interest among diecasters, their chief problem at present being to secure them—or the high-purity zinc which is essential for making them—in sufficient quantities to meet demands greater than ever before. It is now possible to cast these alloys in sections remarkably thin, even for castings of large size. This accounts, in part, for the substitution of diecastings for many parts heretofore built up from stampings, often with savings in die cost, machining cost and assembly cost.

Aircraft demands in sufficient volume to warrant die investments have led to considerable increase in the use of magnesium and aluminum alloys for such parts as can be diecast with assured satisfaction. Some such diecast aircraft parts are quite large in dimensions. The use of cold-chamber machines for diecasting these alloys has grown accordingly because their output is superior for some purposes than are castings from older air-injection machines. Some cold-chamber machines also are used for diecasting copper-base alloys. Air-injection units, however, continue to be used extensively but only for aluminum alloys.

Many more magnesium alloy diecastings are now being made than ever before. Methods for electroplating them are reported just emerging from the experimental stage. If proved successful commercially, they are expected to increase further the utility as well as the extent of use of this lightest and newest group of diecasting alloys.

More Diecasting Users Install Own Production Facilities

BY F. W. McINTYRE
Vice President and General Manager
Reed-Prentice Corp., Worcester, Mass.

■ THE USE of diecastings has become more pronounced, especially in defense work. The high-grade zinc alloy now available has taken the place of brass and tin-base alloys used in the past. Much effort has been concentrated on improving high-pressure machines for producing aluminum, brass and magnesium castings by the positive-plunger or cold-chamber method. The advantages of this method of casting high-temperature or high-purity alloys are so generally accepted, production of the older air-pressure machines has practically been discontinued.

The higher pressures under which the metal is injected and the ever increasing size of parts being diecast have made it necessary to increase locking pressures. At the same time quicker and easier means of diesetting, less

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machine maintenance and more efficient operation make the newer machines a considerable step ahead of previous models.

Another development of the past year is standardization of machines so they may readily be converted from the ladle type, as used for brass and light alloys, to an automatic zinc machine of conventional form. Of course, additional parts are necessary for this conversion. The increased number of manufacturers taking advantage of our engineering and advisory service indicate a growing interest in diecasting. More and more users of diecastings are installing their own diecasting department to afford better control of their quality and production schedules. All these manufacturers find they can make a large saving this way.

Brass Diecastings Now Have Tensiles Up to 110,000 P. S. I.

BY BRUCE W. GONSER
Supervising Engineer
Battelle Memorial Institute, Columbus, O.

■ A TREND in casting machines is to make them all-automatic and hydraulically operated. Machines of all-welded construction have been announced recently. Cold-chamber machines, originally developed for brass diecasting, have largely supplanted goose-neck machines for aluminum and magnesium diecasting since they give less chance for iron contamination and permit pressures in excess of 2000 to 3000 pounds per square inch. Dies for zinc and plastics offer no problem; those for aluminum and magnesium require special alloy steels but are reasonably satisfactory with 200,000 shots not unusual. Insufficient die life continues to be the biggest handicap to growth of copper base diecastings, however. While a steel containing about 10 per cent tungsten and 3 per cent chromium gives fair results, the problem is by no means solved.

Possibly greatest progress is being made in finishing diecastings. Aside from synthetic plastic finishes and anodized aluminum surfaces which can be given attractive colors and have increased corrosion resistance, a jet black molybdenum-nickel-oxide finish on zinc diecastings is now available. Of potential importance, also, is the recent development of white bronze plating which produces a beautiful silver finish on zinc. Too, electrodeposited coatings on aluminum now are possible.

Of particular interest in brass diecastings is an alloy of 83 per cent copper, 10 zinc, 5 silicon, 1 manganese and 1 aluminum with tensile strength as diecast of 110,000 pounds per square inch, 3 to 5 per cent elongation, 200 brinell hardness as well as excellent wear resistance and corrosion resistance. It is being used where high yield strength is needed, sometimes replaces stainless steel.

New Steels Increase Scope of The Forging Processes

BY J. F. RICE
President
Drop Dies & Forgings Co., Cleveland

■ MUCH advance in steels has been made recently so fabricators can meet the demands of modern production requirements. Reduction in weight together with increased strength has been the main objective of the automotive and aircraft industries. The drop forging industry has been called upon to contribute its part in working these advanced steels. The combination of proper laboratory control, die design for correct grain flow, proper heating methods, skill in handling the forging equipment and rigid inspection methods are all important.

Regarding cold forging, satisfactory results have also been obtained both in upsetting and press operations due to steel manufacturers' giving us steels that are properly annealed and cleaned before being cold drawn. The die steel manufacturers have given us steels that will withstand cold forging. With the proper die design and not expecting too much of these steels due to their fine qualities, much is being accomplished by cold forging.

Modern Forging Saves 40% in Stock, 50% in Machining

BY EUGENE C. CLARKE
President
Chambersburg Engineering Co.,
Chambersburg, Pa.

■ A SAVING of 40 per cent in forging stock of a gun part and a reduction of 50 per cent in subsequent machining operations by the use of modern forging practice emphasizes progress made in drop forging since the last emergency. These savings result from the use of new rigid high-impact hammers producing forgings to close tolerance and with almost imperceptible draft, followed by accurate trimming and hot-coining of the part to size. Practically all forgings demanded by the defense program, if subjected to study toward the elimination of excess finish and of subsequent machining, can contribute to the reduction of forging stock, machining tools, man hours, power, etc., necessary to finish parts and so release many such facilities and energies to other essential tasks.

Drop forgings for defense, some 250,000 tons of them, if saving but 5 per cent by manufacture in modern equipment, will release 12,500 tons of steel, some 100,000 machining hours and 1,000,000 horsepower hours. Modern forging equipment is needed to do the job. The drop forge industry has had little encouragement toward modernization in the few years preceding the present emergency, but now prepares to fulfill services expected of it.

Drop Forgings for Aircraft Grow Both in Size and Volume Since 1914-18 Period

BY MACDONALD S. REED
Chief Engineer
Erie Foundry Co., Erie, Pa.

■ SINCE 1914 there have been some outstanding improvements in both steam and board drophammers. Hammers are much more massively constructed and more rigidly built so the dies are readily aligned and held. The force of the blow is concentrated on the work and in the case of steam drophammers, the impact velocity has increased so a heavier blow is struck with the same weight of hammer.

Individual motor drive has been introduced for board drophammers. The 4-roll board drophammer has been introduced making it possible to build board drophammers much larger than before. In the previous period, a steam drophammer rated at 12,000 pounds was the largest in general use. Now ratings of 35,000 pounds are more common than 12,000-pound were then and two hammers rated at 50,000 pounds have been built. About 1910 practically all our output was flat-die hammers of single and double-frame forging types, with only an occasional hammer for making drop forgings in impression dies. At about that time with the growth of the automobile industry we began to sell large installations of drophammers to leading automobile manufacturers as well as to commercial forge shops. A sharp trend upward in the proportion of

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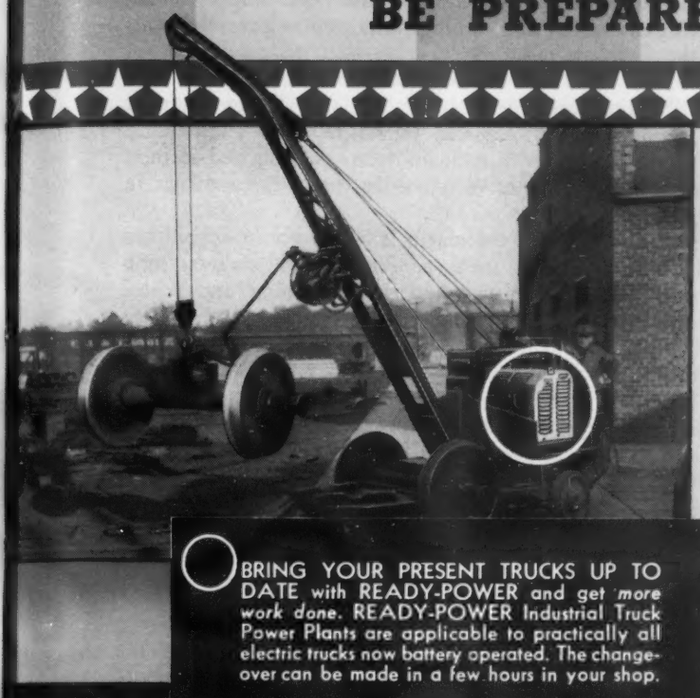

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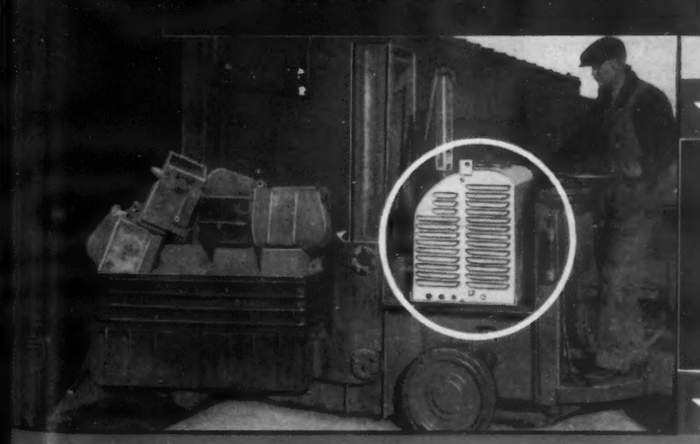

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drop forging hammers continued to the start of the war in 1914, but then the trend was reversed and for the period 1914 to 1918 our sales were about 50 per cent flat-die hammers and 50 per cent drop-forging hammers. Apparently a large proportion of forgings used for war purposes were made between flat dies and machined to size and shape. There were no hammers that today would be considered large, the average size probably being about 1500 pounds.

Now only about 12 per cent are flat-die type, the balance being for drop forging—apparently due to increased appreciation of the advantages of the drop-forging process and technical advances in the industry making possible the forging of parts previously made by older methods.

In the previous war, airplanes were "flying crates" and the few drop forgings that they used were probably confined to the motors. If any forging of aluminum was being done, it was probably on an experimental basis as it was not until a few years after the close of the war that the first hammers were installed in a shop intended for that purpose. That installation has grown until today that shop is undoubtedly the largest drop-forging installation in this country and probably in the world. It is devoted solely to forging the light metal alloys now going almost entirely into aircraft. The sharp increase in the average size of drophammers built is due largely to this development, as, contrary to what the layman would expect, a much larger hammer is required to drop forge a part from light metal alloys than to make the same part from steel. There are only two other drophammers in the country comparable in size with a number of large hammers used for drop forging aluminum airplane propeller blades and airplane-engine crank cases. Along with the parts just mentioned, several heavy structural sections of planes are now being made as drop forgings, this fact being indicative of the quantities in which planes are being produced.

Too Strict Forging Tolerances May Often Defeat Their Purpose

BY WALDEMAR NAUJOKS
Chief Engineer
Steel Improvement & Forge Co., Cleveland

■ THE year 1941 will be one of the most important in the production forging industry as it faces an intensive demand for forgings for defense as well as for extended industrial use. Achievements not believed possible a few years ago are accepted as commonplace today, and to forging users there appear practically no limits in the choice of forgeable metals, close tolerances, smooth surfaces, difficult shapes, thin sections, physical properties and other desirable features that may be had.

Caution in specifications, however, is important because—while many forging accomplishments are possible and entirely practical—the tendency to over-tolerance must be watched. Machining and grinding production practices have reached such a high plane that frequently it is more economical to obtain necessary tolerances by machining or grinding, thus permitting greater tolerances in forging. Too, benefits obtained by extremely close heat treating or physical property tolerances are often more costly than the results warrant. Likewise, other close tolerances which may place the forgings in the difficult class often do not serve their purpose in the manner desired.

It is suggested that available forging engineering and metallurgical facilities be used wherever problems arise. This technical and broad practical experience is especially desirable at this time when it is imperative that production forging facilities be utilized to best serve the country.

Co-ordinate Forging Purchases To Cut Duplication of Die Work

BY R. W. THOMPSON
Sales Engineer
Transue & Williams Steel Forging Corp.
Alliance, O.

■ THE defense program has created a back-log of business that surpasses all records for the last decade. Keeping abreast of advances by acquiring the latest improved die-sinking machinery and forging facilities now pays dividends as the industry has been able to step up production in accordance with our country's rearmament schedule. The high quality standards for drop forgings such as magnetic inspection, close dimensional tolerances, increased physical values and improved machinability are co-ordinated features eliminating the expensive rejections that were apparent in forging work during 1914-18.

The most important problem is how to train apprentices and develop skilled men, particularly die sinkers, millwrights and machinists. Apprentice training and school classes have been established for this purpose and present conditions should provide increased advantages for men with good capabilities.

As there already is a shortage of skilled diemakers, contractors for government equipment should co-ordinate purchasing when the same forging designs are required by two or more manufacturers. Often dies for the same part are needed by several forgers. This practice retards forging delivery and is likewise uneconomical. Proper allocation of such forging parts would expedite the defense program and aid delivery of other much needed parts.

Pleads for Added Standardization Of Steels To Simplify Problems Involved in Defense Work

BY JOHN A. WEBBER
Metallurgical Engineer
Interstate Drop Forge Co., Milwaukee

■ THERE is a decided trend toward eliminating and reducing machining operations by additional operations in the forge shop such as cold coining, cold bending, hot piercing and hot shearing to close tolerances. This has increased the requirements for presses of various kinds. A big problem of the forging industry at the present time is to become familiar with the various new steel specifications appearing almost daily in connection with the rearmament program. The various steels required have been worked out by and are familiar to the various governmental departments. It is, however, a stupendous task to familiarize the steel producers and fabricators with the many steels and other requirements of the Ordnance and Navy departments, including their respective Air Corps.

It is fortunate that the aircraft industry is standardizing upon a few steel specifications. It is, of course, hoped that this standardization on a few steel specifications may be carried over into other fields.

The extremely rapid increase in the number of forgings used by the aircraft industry now involves sufficient volume to justify the purchase of forging dies for many more parts. This has placed a burden on the die-making capacity of the forging industry. Because of the necessity for lightness, most aircraft forgings are designed with deep ribs and thin sections. This results in forgings which are more difficult to make free from defects. At the same time it is absolutely necessary that there be no defect of any kind. The production of aircraft forgings has, therefore, brought about a new high-quality classification of forgings.

New Forging Machines Double Output and Cut Weight of Stock for Shell Forgings 34 Per Cent

BY R. H. JONES
National Machinery Co.
Tiffin, O.

■ A MAJOR development in forging during 1940 was introduction of the high-speed forging press, operating at twice the speed of previous presses. These new machines are handling many jobs formerly thought possible only on hammers. Increased output, lower operating cost and the ability to produce more accurate work with much less finish and flash are real advantages.

Of even greater importance, however, is the lead taken by the modern high-duty forging machine in producing shell forgings for the defense program. To meet the needs of the automotive industry for equipment to produce deep pierced forgings—such as drag links, cluster gears and the like—many radical improvements have been made in forging machines since the last war. In fact, many of the mass production jobs that have been handled on these machines for the past several years are more difficult than the average shell forging.

Shell forgings produced by this method are of highest quality and can be held to such close limits that the inside need not be machined at all and but a minimum of stock need be removed from the outside during finishing. For instance, a weight of 22 pounds is usually allowed for 75-millimeter shell forgings, but they are being produced on high-duty forging machines with a maximum weight of only 14¼ pounds. Obviously this represents vast savings in machining and material.

Too Exact Dimensional Limits Hurt, Not Help, Defense Work

BY THEODORE F. SMITH
President
Oliver Iron & Steel Corp., Pittsburgh

■ THE defense program has placed orders for large quantities of specialized products in the hands of the bolt and nut industry. Over night this specialized production has presented problems seldom, if ever, experienced by the industry. There is not an abundance of highly skilled mechanics available to do the work. Yet speed, co-ordination and efficiency are of paramount importance if defense orders are to be completed on schedule . . . thus the trend toward faster and more completely automatic machinery. Fortunately, machinery builders have developed much new steelworking equipment. In the bolt and nut industry, there is a tendency to combine several operations in one machine. As a result, a complete product can be made on a single machine, greatly simplifying production.

Steel analyses specified on defense orders are, in many cases, new to mass production. In addition, many materials are difficult to form and machine. There has been little tendency to narrow the limits of the steel analyses to produce parts, but there has been a definite narrowing of tolerances on surfaces and finish. On steel wire, rods and flats for many parts needed in large quantities, decarburization must be held to an absolute minimum because it has become evident that to achieve the desired physical properties, it is important that parts must be uniformly hardened to their outer surfaces. Finish has become increasingly important because with the higher speeds and greater stresses, failure may begin from a small, seemingly harmless flaw on the surface. Dimensional tolerances are in many cases being narrowed to such an extent that quantity production is not practical. This should be watched carefully for utility is the first consideration and exacting dimensional tolerances should be secondary so mass production may best serve the interests of our armament program.

Improved Fastenings Now Find Ready Acceptance

BY A. E. R. PETERKA
Advertising Manager
Lamson & Sessions Co., Cleveland

■ DURING the recent years of industrial inactivity, aggressive bolt and nut manufacturers encouraged their production and engineering staffs to develop new and more efficient "fastenings." As recently as 1939, the fruits of this intensive development work went begging. Today, buyers of fastenings and engineers who specify them no longer hesitate to adopt modern fastenings such as the new recessed-head screws, self-locking nuts, bolts and nuts for welding purposes, self-tapping screws, bolts especially designed for wood construction, pre-assembled lock washer screws, double-thread lag bolts, high-tensile cap and set screws, Dardelet threaded products and many others.

The same buyers and engineers who hesitated 18 months ago are now specifying these new products because their production requirements are large enough to show a marked saving by their adoption and because their managements are now insisting that they procure those fastenings best able to increase production and otherwise reduce overall costs. Just as the automobile industry tremendously improved standards of "fastening" quality and production, so the high standards of the aircraft industry involving close dimensional tolerances, exact physicals, super finishes and accurate plating specified for aircraft bolts and nuts in production quantities are manifesting themselves in improved machinery, superior manufacturing processes and precision inspection methods and equipment being developed by the "fastening" manufacturers. Undoubtedly much of this advance will carry over into other fastening fields.

Riveted Joints Speeded by New Automatics Which Set 3 to 5 Rivets Simultaneously

BY FERNE P. DWELLEY
Tomkins-Johnson Co.
Jackson, Mich.

■ MANUFACTURERS of automatic rivet setting machines find the defense program emphasizes the importance of finding means for still further increasing the speed of producing riveted joints. More versatile machines are needed to handle a wider range of requirements and to facilitate changeovers. The design must permit them to be built up to a variety of throat-depth and throat-drop requirements. The machines are being constructed so that entire anvil mechanisms can be removed and replaced by the one required for the next job with little loss of time.

Too, time is saved by doing both piercing and riveting in one handling of the work. Developments are going forward to accomplish a riveted joint in previously unpierced work by an automatic feed machine that uses the rivet as a punch to pierce the work, then sets rivet.

Setting stroke speed in single rivet setting is now generally adequate in most automatic rivet-setting machines. Much has been done to cut down handling time by tooling the riveting machines to accomplish automatically the assembling job prior to double rivet setting as requests are for machines to handle settings of three, four and five rivets at a time. Machines that will feed from two to five different types of rivets, the type selective at the operator's will, also are being required.

Spring Tension Fasteners Fit Speeded Tempo of Defense Work

BY GEORGE A. TINNERMAN
General Manager
Tinnerman Products Inc., Cleveland

■ WITH costs of raw materials, labor, interest, taxes, etc., relatively fixed for most plants, management today is looking to *assembly* as the one flexible cost factor remaining. Assembly methods and fastening devices are undergoing a revolutionary change in all leading industries. So flexible is this phase of manufacture that in many cases fastenings have been engineered to replace as many as four other parts, with a proportionate reduction in assembly time.

From a metallurgical viewpoint, we are coming into the spring-tension era. Hundreds of designs challenge the imagination. They are applied faster, are lighter in weight and solve the countless problems of vibration, at the same time providing a resilient cushion to the assembly that insures the protection of glass, porcelain and ceramic parts. The two most important phases of spring tension assembly engineering are devices for blind locations and for cutting excess weight.

The size of this trend to spring tension fastenings can best be illustrated by our own production requirements, which have increased 500 per cent over 1938. New developments in the immediate future will be applied in aircraft and other units of defense because of the increased assembly speed and the remarkable resistance to vibration that is inherent in properly heat-treated spring steel fastenings.

New Hand Tools Prove Great Aid in Speeding Assembly

BY NEIL C. HURLEY JR.
Vice President
Independent Pneumatic Tool Co., Chicago

■ THE whole tool industry is one of those "behind the scenes" industries which help make the wheels go 'round. The bottleneck of any industry is fastening pieces together, so any improvement is certain to speed up manufacturing as everything manufactured has to be assembled. Suppose a million pieces are stamped out by one machine, a million more by another. When these parts are put together, the speed of the big machines is of little value unless power tools can fasten the pieces together as rapidly as they are made.

A new device for aircraft production is the rivet squeezer. Each plane averages 75,000 rivets. With each driven separately by hand, building a plane virtually is a hand job. The rivet squeezer contributes greatly to production since it increases the speed of driving rivets about 500 per cent.

Another important new device is a pickup finder for electric screw drivers. It automatically picks up a screw from a slotted tray and holds it ready for driving. We believe this device next year may cut the cost of alarm clocks, radios, washing machines and other home equipment as it enables greater speed in assembling almost any article.

Portable Hydraulic Cold-Riveters Found Able to Speed Army Truck Manufacture

By OTTO J. MAHA
Vice President, Chief Engineer
Hannifin Mfg. Co., Chicago

■ FABRICATION of army trucks for the defense program already has been greatly expedited by use of cold riveting 7/16-inch and ½-inch rivets on truck chasses. The method has been almost universally adopted during the past few years. The portable hydraulic cold-riveters now in use in automotive plants are ready for immediate adaptation to army truck requirements. Where dependability must be assured and a structure designed to withstand the severe shocks and stresses of field service, the cold-riveted joint is yet to be surpassed.

Cold riveting from the standpoint of safety is indispensable. In this emergency where time is the keynote, labor is more effectively employed, noise is eliminated, waste time is greatly reduced. The resulting better joint can be relied upon without further costly inspection. These advantages and lower costs are possible when using hydraulic squeeze riveters.

In making army tanks to withstand tremendous shell impacts, the alloy steel rivets used to fasten the sections of armor plate in place are compression riveted, squeezing 5/8 and ¾-inch rivets with air or hydraulically operated machines. Riveted joints on tanks have proved best by actual gunfire tests.

Unusual Construction Permitted By New Fastening Method

BY ERNEST SCHAEFER
Schaefer Permagrip Enterprises
Cleveland

■ SINCE industry has the big task of speedily "producing the nation's preparedness requirements," it is striving to devise new methods for adapting the various kinds of units to mass production. Of special interest is a recently perfected method of strong concealed fastening. Snubbed and coiled action applied to the outer metal covering reduces the number of fastening units needed to hold structures firmly together to astonishingly few. Providing a sleek, smooth, streamlined exterior with neat close-fitting joints, it lends itself admirably to building various sections of a structure as subassemblies for later general assembly. Such structures, moreover, are readily accessible for repairs and replacements. Rapid secure assembly and quick dismantling make the method advantageous in designing for knocked-down shipment and portability.

Utmost tensile strength of ferrous and nonferrous metals, in light or heavy gage, is successfully utilized for strain bearing. Armor, which gets its protective properties through heat treatment, now can be treated to maximum hardness because no holes are required in the armor, neither is it necessary to weld it. Warping is also largely overcome. Potential military uses of this method include the construction of airplanes, trucks, trailers, cars, trains, tanks, boats, barracks, and also equipment needed in refrigeration, fireproofing, bullet proofing, air conditioning, sanitation and acoustic treatment.

Spring Fasteners Expand Use of Plastic Parts; Snap-In Plugs Simplify Stampings

BY C. L. HALL
United-Carr Fastener Corp.
Detroit

■ INTEREST in spring clips to fasten metal parts together increases constantly. Where formerly bolts and nuts were considered necessary to attach parts, now many are held on by ingenious fasteners made of tempered high-carbon steel. This not only speeds up production and eliminates the need for lock washers but also prevents rattles caused by loose nuts.

The popularity of plastics for ornamental use made it necessary to develop economical attaching methods. Several inexpensive designs have been found efficient for this

purpose. In many cases the availability of cheap fasteners now makes it feasible to use plastic parts.

The use of so much optional equipment on automobiles greatly expands the applications for snap-in plug buttons. They are really essential to production methods because they enable the manufacturers to keep their stampings uniform and simply plug up unused holes with plug buttons.

We are still waiting for a material that will have spring steel characteristics but will still be sufficiently tough so that it can be clinched to a cardboard or a fabric member by means of prongs. A partial solution is 28 per cent carbon steel, but a material that would clinch with still less breakage is desired.

Standardizing Sizes, Shapes For Welded Construction

BY H. C. HETTELSATER
Standards Engineer
Harnischfeger Corp., Milwaukee

■ NOW that arc welding has proved both economically and technically acceptable, we can look forward to its being further refined and developed as a production tool. Improvements in technique will result in still greater economic advantages. The basic materials for welded parts have been perfected by steel producers and by electrode manufacturers to a point where these materials are especially suited for arc welding. It is now possible to produce parts from either carbon steels or low alloy steels with a marked freedom from air-hardening effect in the zone adjacent to the weld. This opens up new applications of arc welding to machinery parts and frames subjected to high impact stresses from shock loadings.

Progress also has been made in methods of inspecting welded parts and this has built up confidence in welding as a substitute for the older methods of production. Another point receiving serious attention is simplification and standardization of materials and shapes. Already a substantial reduction has been effected in the number of types and sizes of materials used by setting up a predetermined list of standard items to be used by designers in working up welded assemblies. Extending this program will benefit the defense program by accelerating the production of machinery and at the same time will benefit steel producers by cutting the number of small orders for odd sizes, thus allowing concentration on larger unit orders.

Welding Seen to Offer Almost Unlimited Possibilities In Defense Work

BY LEON H. JOHNSON
Chief Engineer
Struthers-Wells, Warren, Pa.

■ ENGINEERING from its earliest inception has been a problem of fastening materials together. From the stone-age man whose problem was to keep a stone fastened to a stick of wood, up through the ages, the armament advantage has been with those who could best fasten and hold materials together. The development and use of welding over the past decade has been so steadily rapid and extensive as not to attract unusual attention. Welding has now practically displaced all other forms of permanent metallic fastenings.

Over the past year, equipment, electrodes and procedures have been steadily improved to the point where all commonly used metals or combinations of these metals can be welded together for safe and satisfactory service. Welding electrodes and procedures will now produce metals better in mechanical properties and corrosion resistance than the base metals they fasten together.

The significance of welding in armaments is that it presents unlimited possibilities for reductions in material, labor and time costs where overall time requirements are extremely vital. Its possibilities are almost unlimited.

Predicts Important Advances In Resistance Welding Field

BY J. W. MEADOWCROFT
Assistant Works Manager
Edward G. Budd Mfg. Co., Philadelphia

■ RESEARCH work on resistance welding will be more than doubled in 1941. Results from such research already are proving of immense value in meeting the speed requirements of the defense program and will be of primary importance in the subsequent economic adjustments that will follow. Through a continuation of resistance welding research, steady improvement in the quality of products fabricated by resistance welding can be anticipated. Manufacturers of resistance welding equipment, by applying the findings of the research laboratories, will undoubtedly build machines of a higher standard of efficiency than ever before. These will not only be of great assistance to industry in the United States, but will be superior to any other resistance welding equipment in the world.

There will be closer co-operation among the engineers who design resistance welded structures, the research laboratories, and the welding engineers. Without any question of doubt, more progress will be made in the use of resistance welding in the next three years than has been made in the last quarter of a century.

Fundamental Research in Colleges Cuts Duplication of Effort By Individual Companies

BY A. P. YOUNG
Associate Professor of Mechanical Engineering, Michigan College of Mining and Technology, Houghton, Mich.

■ THE American Welding society regularly publishes "Review of the Literature" on welding and associated processes. These reviews aid industry in getting the latest information available, and also information presented by authors working on fundamental research helps to avoid duplication of effort or repetition of mistakes which research has proved can be avoided. This is a most important contribution.

The defense program with its increased industrial activity involves the problem of how to obtain skilled operators and how to decrease the amount of special training and orientation necessary for such new employes. Two things that will help are: First, industry can and should support in a larger way the research program now carried on in many colleges and should establish research in more of the colleges which do not have a sponsor for research or available funds. Such increased co-operation between industry and educational institutions would show increasing benefits to both parties—research would develop unhindered by localized conditions and industry could give its undivided attention to production.

Second, industry should take advantage of the facilities of all vocational training centers or courses offered in educational institutions to help train men. Such training courses relieve companies from giving special training in their own plants. Industry can well afford to co-operate

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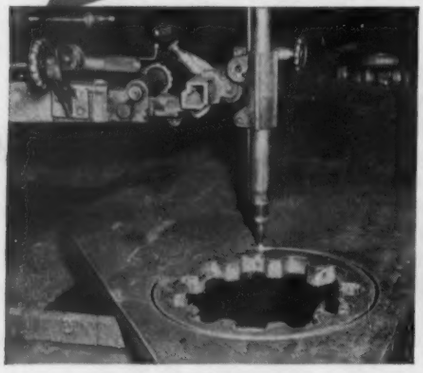
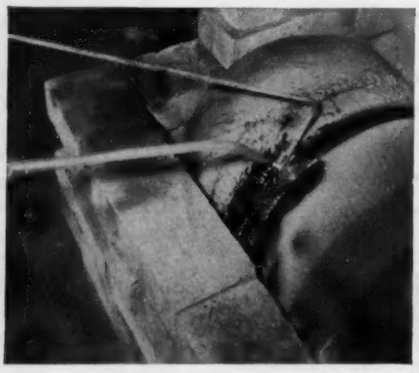
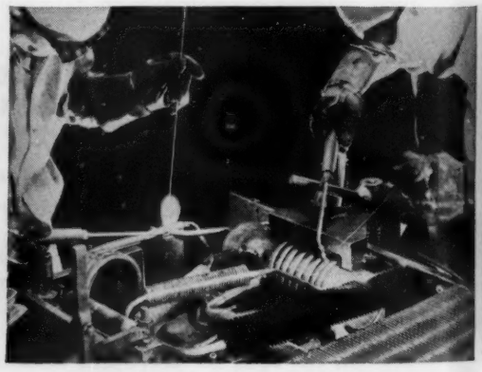


For shaping steel—Flame-cutting is one of the fastest methods of shaping steel—in straight lines, circles, or irregular shapes. It reduces, and in many cases completely eliminates, subsequent machining operations.



For maintenance—Welding and cutting offer many short cuts to the maintenance of plant and equipment; frequently save large sums by reclaiming damaged parts; and often help avoid costly shutdowns.



For fabrication—Oxy-acetylene production welding, both manual and automatic, is widely used. Linde's automatic electric process, "Unionmelt" welding, is also used effectively in many industries.

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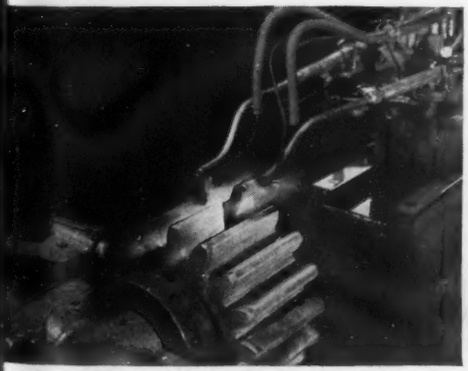
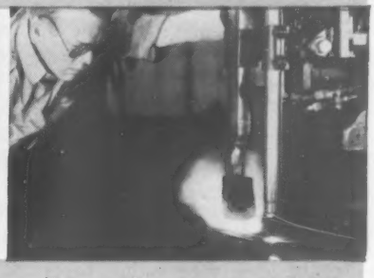


For treating metals—Oxy-acetylene flames are used to harden steel and iron parts; to remove scale from forgings and castings; to clean structural steel before painting; and to anneal, bend, straighten, form, and spin metals.

Process Literature – Linde literature, and a monthly magazine, OXY-ACETYLENE TIPS, tell shopmen "how it is done."



Research—From Linde's laboratories come new processes and apparatus ready to go to work for Linde customers.

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by supplying special instructors and helping to organize the training courses to dovetail with production methods as men so trained can be transferred directly into production in most instances.

Welding, Fully Applied, Would Reduce Machine Tools Required For Defense by One-Fourth

BY A. F. DAVIS
Vice President
Lincoln Electric Co., Cleveland

■ PRODUCTION for national defense just could not go forward without welding. Not only would it be impossible to manufacture products and build structures which the economy and speed of advanced welded procedure, but what is probably more important — many modern products and structures just could not be produced.

Statistics recently compiled by The James F. Lincoln Arc Welding Foundation—from its extensive files of industrial case studies—show that production in welded steel is 20 to 50 per cent faster and 25 per cent more economical than less modern methods while providing notably higher structural quality. Welded construction is also shown to reduce machining time an average of 26 per cent. This saving in machining is vital in the present emergency since it offers relief for the bottleneck created by shortage of machine tools. Fully applied in defense work, welded construction would save a tremendous amount of valuable time. With $772,000,000 worth of machine tools required for production of existing defense orders, a saving of 26 per cent in machining time would actually mean that one-fourth fewer tools would still be able to do the job.

From these indications of what welding is contributing and could contribute to industrial progress, there can be no doubt of the tremendous significance of this modern process of manufacture, fabrication and construction.

Fundamental Welding Research Greatly Speeds Progress

BY COMFORT A. ADAMS
Consulting Engineer
Edward G. Budd Mfg. Co., Philadelphia

■ ALTHOUGH the past year has seen many practical improvements in the apparatus and technique of welding, the most significant development has been in the direction of a more thorough understanding of the phenomena involved and in the tendency toward a more rational and scientific attack of welding problems. A great many serious problems in welding high-tensile and alloy steels as well as of nonferrous metals and alloys cannot be solved satisfactorily except by the scientific method. For this reason the writer for the past 20 years or more has insisted on the importance of fundamental research. To such work is due the striking advance that has marked the evolution of welding in the past year or two. Two illustrations may be cited.

Welding Oil Well Casing: This difficult and important problem was accurately solved by a combination of mathematical analysis of transient heat flow, beyond the range of the majority of engineers, and the very latest knowledge of the metallurgy involved. Moreover, the results of this careful study, because of its rational nature, will be immensely valuable on many other projects.

Resistance Welding: A leader in this field recently stated that it had advanced further during the past 3 years than in the previous 30. It was just 3 years ago that the first fundamental research in this field was started under the auspices of the Welding Research committee. The value of this co-operative method lies not only in the experimental results obtained, but to an even greater degree in stimulating the large number of co-operating engineers to think more deeply about their own problems and to apply more soundly the rational or scientific method to them.

Composite Welded Dies Permit Important Cost Reductions

BY A. R. BUTLER
Welding Equipment & Supply Co.
Detroit

■ DURING 1940, tool and die welding in industry has come into long merited prominence. More rapid strides have been made in various neglected phases. Tools and dies, being vital factors in production, have a direct bearing on our national defense program. Industry now appreciates the vast economies afforded in inexpensive die construction methods, such as utilizing a base of either mild or medium carbon steel or an SAE steel, with water, oil or air-hardening steel (or hot-working steel) electrodes applied by arc welding along the cutting or working edges. This results in a fabricated composite die which efficiently replaces a die constructed of highly expensive tool steel. The same construction principle can be followed on drawing and forming dies, by placing special alloys along sharp contours and radii to meet most strict requirements and to prolong die life and avoid costly maintenance.

Virtually any type of tool steel lends itself to repair by arc welding. In most instances neither complete dismantling nor subsequent heat treating is necessary, effecting a great saving of time—an element of vital importance on defense work. Typical examples of this trend toward inexpensive dies for such operations as blanking, trimming, embossing, coining, forging, drawing and forming is the fabrication and maintenance of hot-working punches for upsetting work on shells where longer life of these dies permits less frequent replacement of punches. This type of punch is a typical hot-working steel. This construction affords greater hardness and higher tensile strength without embrittlement in the base metal and its resultant early fatigue.

Mechanized Welding Given Added Impetus in 1940

BY J. H. ZIMMERMAN
Development Manager
The Linde Air Products Co., New York

■ MECHANIZED oxyacetylene welding is being increasingly employed as a regular production tool. In many instances its use substantially reduces operating costs, improves product quality and increases output. Installation and maintenance costs are comparatively low, and the reduction in amount of cleaning and grinding needed after welding, together with smaller reject losses, make overall operating costs comparable to other automatic welding methods much less adaptable to changing production methods. Mechanized oxyacetylene welding is an extremely flexible process, easily handling a wide range of gages and sizes of material. Developments in welding equipment make it possible to obtain consistently full-strength welds at high welding speeds. Often multiflame tips first preheat the rod and plate and then do the actual welding. Welding rod for

12-gage material and heavier often is added automatically through a variable-speed feed. Developments in rollers and jigs for feeding and holding the material are important.

Mechanized oxyacetylene welding is being employed with particular success in welding tube, strip, tanks, cylinders and other types of containers. Mechanized methods are also being applied to bronze welding, using a volatile liquid flux for automatic fluxing. Waste due to excessive use of flux is impossible and the work is considerably speeded. Automatic bronze welding is being used to assemble steel parts on a production basis and to apply bronze to bearings.

Production welding by hand also is increasing. Jigs and production-line methods aid in obtaining extremely uniform results. One manufacturer uses a conveyor system to keep parts in motion on a production line between successive steps in welding. The entire fuselage of light aircraft is welded of chromium-molybdenum tubing and hundreds of small component parts, fittings and subassemblies attached by another user.

Stored-Energy Welding Aids Aircraft and Automotive Work

BY F. EDER
Robert W. Hunt Co., Engineers
New York

■ STORED-ENERGY welders, utilizing either inductances or condensers, represent a notable advance in resistance welding. Their proper use results in excellent resistance welds in aluminum and aluminum alloys, important in fabricating aircraft and automotive parts. Undoubtedly they also will prove useful for resistance welding stainless and similar alloy steels. In addition, the stored-energy principle results in a considerable saving of power as well as a saving in initial cost.

Numerous refinements have been developed in weldments of various kinds. For example, in shipbuilding, bulkheads are prefabricated by automatic Unionmelt welding. It is noteworthy that the use of alternating current in manual arc welding has increased both in shipbuilding and in welding such structures as armored tanks, mainly because it obviates the objectionable feature of magnetic blow. Standardization of codes for welding has made further progress, an example being the actual or proposed inclusion of the standard qualification procedure of the American Welding society in a number of codes.

Stored-Energy Welding Valuable In Aircraft Production

BY CARL de GANAHL
Vice President
Fleetwings Inc., Bristol, Pa.

■ THERE has been of late a very significant increase in the amount and the extent of electric resistance welding of aluminum alloys in aircraft. Spotwelded aluminum alloys have begun to creep into basic structures for aircraft and are rapidly becoming of primary importance in aircraft production—now possible by notable advances made in suitable welding equipment. The extremely high electric and heat conductivity of aluminum alloys makes necessary spotwelders of high capacity. Such welding machines create severe shock loads on power supplies causing some interference with other apparatus as well as complicating welder controls.

These defects have been alleviated tremendously by employing a set of condensers which are charged steadily at a relatively slow rate. The energy thereby stored in the condensers is then released through the primary of a spotwelding transformer with exact control of the discharge rate possible. The result is a fairly uniform load on the main power supply, and tremendous simplification of the problem of controlling the energy input to the weld. This latter in turn affords excellent control of the character of the weld made, thereby greatly improving the reliability and strength of the welds produced. I anticipate a tremendous increase in the proportion of spotwelding in aluminum alloy aircraft structures in the near future. This should, to some extent at least, simplify the important expansions necessitated by the defense program.

Significant Progress Reported In Electrode Standardization

BY J. A. WEIGER
Vice President
P. R. Mallory & Co. Inc., Indianapolis

■ PHASES of resistance welding electrode standardization completed during 1940 by the Resistance Welder Manufacturers association include: Nomenclature, taper tips, water-cooled holders, seam-welding wheels, and a welding chart which gives information on proper tip materials, weldability and special information for spot welding many similar and dissimilar metals. Tips have been developed which give satisfactory results on the new stored-energy spot welders.

Very commendable work has been done by the Resistance Welding Research committee of the American Welding society in collaboration with the American Society for Testing Materials on tip design, contact resistance and methods for testing spot welds in tension, shear and fatigue to produce uniformly high-strength welds. The technical papers on electrodes during 1940 are evidence of the importance conceded to these very vital parts of the welding machines. The plans for further research and development by the Resistance Welding Research committee, electrode manufacturers and users, and additional standardization by the Resistance Welder Manufacturers association will provide electrodes that will produce even better and more uniform welds in the future.

18-Gage 18-8 Stainless Now Is Welded Automatically By Smothered-Arc Process

BY T. R. LICHTENWALTER
Republic Steel Corp.
Central Alloy Division, Massillon, O.

■ THE past few years have found a remarkable increase in the use of stainless alloys containing 12 per cent or more chromium, and 17 per cent chromium plus 7 per cent nickel and upwards. Stainless is used in radio equipment for springs so tiny they look like jewelry. On the other hand, stainless is used for huge vessels weighing many tons, largely assembled by welding.

One of two newcomers in automatic welders is similar to the automatic metallic-arc type of welders known in the past, but is arranged to feed the required flux around the electrode as the bare filler rod is fed through the automatic head. The other is the "smothered arc" system. As its automatic head is guided down the seam, granulated flux is fed in ahead of the bare electrode to envelope and protect the arc. Some flux is fused and covers the molten pool. This fused slag protects the weld till cool, yet it can be easily removed. Resulting welds are of good quality, being uniform in both penetration and amount of reinforc-

ing. Butt and lap welds have been made in this welder on as light as 18-gage, 18-8 type stainless, in 20-foot lengths.

Another new arc welder is claimed capable of welding 28-gage, 18-8 stainless. This welder employs rectifier tubes to convert alternating line current into direct current for welding. Small-diameter shielded electrodes are required. Successfully welding thin gages depends only on proper fixture design and operator skill for this welder correctly meets the heat requirements.

New Heavy Duty A-C Units Expand Alternating-Current Welding

BY R. F. WYER
Industrial Dept.
General Electric Co., Schenectady, N. Y.

■ A STRIKING trend toward the use of alternating-current arc welders was noted in 1940. Atomic hydrogen welding also met with increased interest. The swing to alternating-current welding is probably most apparent in shops where heavy work is being done and where welds can be made in the horizontal or flat position. Many shops fabricating plate from ¼ to 1 inch have standardized on alternating-current arc welding, using only sufficient direct-current welders to handle special work. Industrial shops using welding as a production method have also turned more and more to the use of alternating-current welders.

Tool shops and mold-and-die shops have specialized in atomic-hydrogen welding. This process is particularly adaptable to work requiring rapid operation, the addition of relatively small amounts of material, and welding on materials for which suitable metallic arc welding electrodes are not available. New welding equipment includes a low-priced 200-amp arc welder operating at 3600 revolutions per minute for heavy-duty service, newly designed 300 and 500 amp arc-welding transformers with inbuilt power-factor correction to eliminate the objection of low power factor encountered with conventional welding transformers of large capacity. The new units provide a power factor above 90 per cent for loads from 40 to 80 per cent of rated current. Fan-forced ventilation provides extremely rapid dissipation of heat, permitting their use on high-duty cycles.

Welded Aircraft Joints Will Have Tensiles of 200,000 P.S.I.

BY GEORGE V. SLOTTMAN
Manager, Applied Engineering Department
Air Reduction Sales Co., New York

■ OUTSTANDING progress has been made in flame machining—removing metal by surface oxidation. It is analogous to tool machining, except that the tool used is a large oxygen stream. It utilizes the same chemical reaction as flame cutting. Closely associated with flame machining is hand gouging, principally used for removing defective welds, the roots of welds and defects beneath backing up strips. Further, it is sometimes advisable to gouge manually for "U" curves on edge butted plates rather than set up a machine as when flame machining. Close co-operation has been established with shipyards with the result that many special cutting machines have been developed for such unusual jobs peculiar to this industry as cutting lightening holes in floor plates, I-beams to T-shapes and channels to ship ribs, using light-weight portable machines in most cases.

Here are some things manufacturers of oxyacetylene flame equipment are doing to help the national defense program: An alarming shortage of qualified welders is being met by operator training schools springing up all over the country. Oxyacetylene training exercises, lectures for instructors, together with other informational aids such as wall charts showing cross sections of torches and regulators are now available.

Aircraft manufacturers desire to weld faster and to make stronger joints. Research indicates that welding rods suitable for welding aircraft assemblies of SAE 4130 and 4130X for subsequent heat treating to tensile strength as high as 200,000 pounds per square inch will soon be available. Special tips have been developed to facilitate welding the clusters of tubing on work of this character.

Tests, Not Certificates, Are Measure of Welders Skill

BY E. R. FISH
Chief Engineer
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

■ TREMENDOUS growth of the defense program has further stimulated the use of welding and is calling for welding operators. But competent mechanics of this kind are relatively scarce and consequently are in great demand. As a result, many incompetents are offering their services as "welders," often holding certificates that may or may not be significant. Frequently they convey a wholly erroneous impression of the man's ability. Also numerous schools for welders have sprung up. While many are excellent, there are a large number interested only in collecting a fee. These give only a smattering of instruction.

If reasonably good and sound welds are to be produced, welding operators must be instructed and trained properly, and no operator should be employed on work that is dependent on the strength of the welds for the safety of the structure until his ability to do the kind of work desired has been proved by an actual and adequate test.

Unless a certificate is specific as to details of the method of welding employed, the kind and thickness of material used, the position of welding, and so on, that certificate is worthless. At best, a certificate only justifies the tentative employment of the holder pending a demonstration test. Even when the certificate details the several vital factors mentioned, it still is necessary that the man prove by actual demonstration, that he has the desired skill. The American Welding society has appointed a "committee to outline minimum requirements of instructors for operators in trade schools." This committee is at work preparing such requirements which, when completed and published, should be made mandatory.

Full Advantages of Welding Await Proper Design Changes

BY GEORGE T. HORTON
President
Chicago Bridge & Iron Co., Chicago

■ EQUIPMENT and materials for welding steel have advanced sufficiently to justify belief that in the near future all metals, at least all steel work, will be welded. Further advances are constantly being made—alloy steels are in general use and special alloy linings in mild steel containers are proving their merit. Resistance welding will attain even greater importance with co-ordinated efforts to improve performance and efficiency.

Naturally, welding appealed from the start to builders

of tank and plate metal structures where their product must not alone be structurally sound but also tight against leakage—always difficult in riveted work and so easy in a welded job. Welding normally should be equally attractive to shipbuilders and some progress has been made. However, shipbuilding codes having the effect of laws must be modernized.

It is surprising to note how many engineers fail to realize that quite radical changes in design may be necessary before the full advantage of welded construction can be attained. Welding is not as yet much used in the construction of buildings and bridges, and the above statement is made with these particular opportunities in mind.

Data on Weldability of Metals Extends Field of Welding

BY CHARLES H. JENNINGS
Chemical and Metallurgical Department, Research Laboratories, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■ MOST important advances in welding have been directed toward improved weld quality and result from new and improved machinery, improved electrodes and metallurgical investigations on the weldability of metals. An outstanding development is the stored-energy spot welder. The "high-wave" current cycles obtained with these machines, in combination with proper electrode pressure control, make possible excellent aluminum and aluminum alloy welds.

Welding electrodes are being steadily improved, particularly with respect to weld quality. Possibly greatest advances are in the nonferrous, cast-iron and hard-facing fields. Machinable cast-iron welds are common. Coated aluminum and manganese bronze electrodes are available that will produce deposits equal in quality to parent materials. Hard-facing electrodes can be obtained to produce almost any hardness or wear-resisting property desired.

The modern trend toward the use of alloy steels and heavier sections has created a need for fundamental knowledge of the weldability of metals. This need has been realized and a great deal of information is now available. Hydrogen has been proved responsible for "fish-eyes" and other faults in welds, the "S-curve" has been advanced as a means of predicting the weldability of steels, and other tests are being developed to obtain weldability information.

New Uses for Perforated Metals Bring Many Production Problems

BY D. McM. BLACKBURN
Production Manager
Hendrick Mfg. Co., Carbondale, Pa.

■ THE many new applications for perforated metals, together with the already wide and diversified uses of these metals, present constant and varied manufacturing problems. Demands are for perforated screens which must be heavier, harder, tougher and more resistant to abrasion than ever before. Screens made from metals resistant to acid, corrosion and heat are being used in increasing quantities. Perforating nonmetallic materials such as fiber, paper, canvas, rubber and various plastics is a constantly growing field.

Back of the ever increasing ornamental patterns is an industry which knows no end of research, engineering and experimentation. Tools must be improved and rebuilt continually. Punches and dies must have keen cutting edges and must retain these edges under heavy and continuous shock loads. This means that only the very best of tool steels, carefully heat treated and tempered, can be used. Punch presses vary in size and capacity from those comparable in size to the household sewing machine to units that exert a pressure of over 1000 tons.

The year 1941 will see continued increases in the uses of perforated metal because of the greater versatility of this product. The efficiency, accuracy and longer life of perforated screens aids handling coarse and granular materials. These screens are made with any shape or size of opening; viz. round, square, squaround, hexagon, slotted, tapered, etc., and are made from various kinds of steel, many heat treated after perforating. Architectural and ornamental perforated metals are not only beautiful but are most durable. Furnished in every kind of metal, they are proof against the action of the elements as well as fire. Finished mirror bright, or dull satin; rich mahogany, or dark walnut; or unfinished, the demand is ever increasing.

Stamping-Forming Runs Increased 300 Per Cent by Cadmium Plating the Material

BY J. G. JOHNSTON
Superintendent
International Business Machines Corp.
Endicott, N. Y.

■ THE trend in stamping and forming operations today is toward automatic production of the completed part at high speed. Whether the part be pierced, trimmed, blanked or shaved, any or all of these operations are now being combined with intricate forming or bending operations in one progressive die or series of dies on a single press, thereby eliminating secondary operations and rehandling of the work. This, in turn, demands, more than ever before, the use of multislide presses. We must plan continually to produce more and more parts by this means. Coining and swaging also play an important part in cost reduction and there is a very definite trend to increased use of these methods.

Naturally, dies for these operations are more intricate, being built from the very best materials obtainable to insure long uninterrupted runs. With this combination of operations being performed automatically, greater demands than ever before are being made on the mills as uniformity of metals in both temper and alloy is most essential. On a certain job run on multislide presses, it was found that the length of run between grinds was increased 300 per cent by cadmium plating the particular material being used. The plating seems to act as a lubricant, keeping the dies in good shape and increasing production accordingly. Another new or comparatively recent development is use of powdered metal with much more progress in sight.

Automatic Stamping and Forming Increases in Defense Work

BY F. K. SIMMONS
President
Henry & Wright Mfg. Co., Hartford, Conn.

■ WITH necessity for rapid increases in production both in ordinary industrial and defense activities, makers of automatic presses have been called upon within the past year to increase greatly the scope of their activities. Many items previously thought to involve production quantities insufficient to warrant full automatic tooling are now required in such quantities as to make automatic press applications definitely advisable. Also it has been necessary to increase the efficiency of production of various other items already automatically produced.

As a result, higher speeds of operation have been made

more generally available and various special attachments are now offered as optional features to permit greater operating speeds without attendant increase in risk of die damage. Numerous special single-purpose automatic presses have been developed for particular production requirements, many of these being for the manufacture of munitions items now required in great quantity. Carrying out the idea of greater production efficiency, many models have been "streamlined" in design. While not physically affecting operation, this has a psychologically beneficial effect upon operating personnel.

Present indications are that the defense program requirements will heavily load the press industry in general and the automatic press industry in particular throughout the coming year, but it appears that the industry is taking steps to provide for its normal customers in the most favorable manner possible both with reference to further technical developments and the furnishing of required presses within reasonable delivery period.

Induction Heating Extended To Handle Entire Cross Sections

BY H. S. RAWDON
Chief, Division of Metallurgy
National Bureau of Standards
U. S. Department of Commerce, Washington, D. C.

■ CONVENTIONAL methods and equipment for heat treatment of steel have reached such a high stage of perfection that any lack of outstanding developments in the field is no reflection against the industry. The spectacular advances are being made in the specialty field. Particular mention should be made of those methods in which each piece receives individual attention—a tailor-made job, so to speak. The two outstanding ones are those utilizing electric inductive heating and flame treatment.

Induction heat treatment, already an outstanding commercial success for surface treatment work, is being extended to articles which must be heat treated through the entire cross section as is done in the more conventional processes. The ease with which this can be accomplished, and the fact that the treatment can be confined to certain local areas if desired, is a very obvious advantage of the method. Too, its cleanliness and economy of energy required are important features.

The same may be said of surface flame hardening. Large massive pieces which require only surface treatment can be handled by almost no other means—likewise complex shapes which require special hardening and strengthening at certain vital local areas. Heat treating along each of these two lines is really in its infancy despite the marked advance already made.

Fund of Technical Knowledge Shows How to Use Off-Heats

BY ARTHUR E. FOCKE
Diamond Chain & Mfg. Co.
Indianapolis

■ THE NECESSITY of providing high quality parts in the shortest time presents a challenge which must be met. It is no longer always possible to obtain in a reasonable time the material one would ordinarily use so substitutes must be considered. Also with production at capacity, off analysis heats and shipments with physical properties which deviate from the specification will be frequent, and decisions must be made as to whether or not such material can be used. In more normal times, trial lots followed by acceptance tests made by processing a small part of the material into the finished article would be requested but such procedures would be too long now.

It will be necessary to decide these questions on the basis of technical knowledge and experience. It is fortunate that American industries have built up their test records and supplied an enormous amount of information of this kind to the public through the various technical societies so an intelligent approach to this problem of substitution can be made. As an example, knowledge of the hardenability of steel, while far from complete, has advanced to the point where reasonable assumptions can be made on the strength and hardness that can be expected in various shapes and sizes with variations in the chemical analysis and grain size.

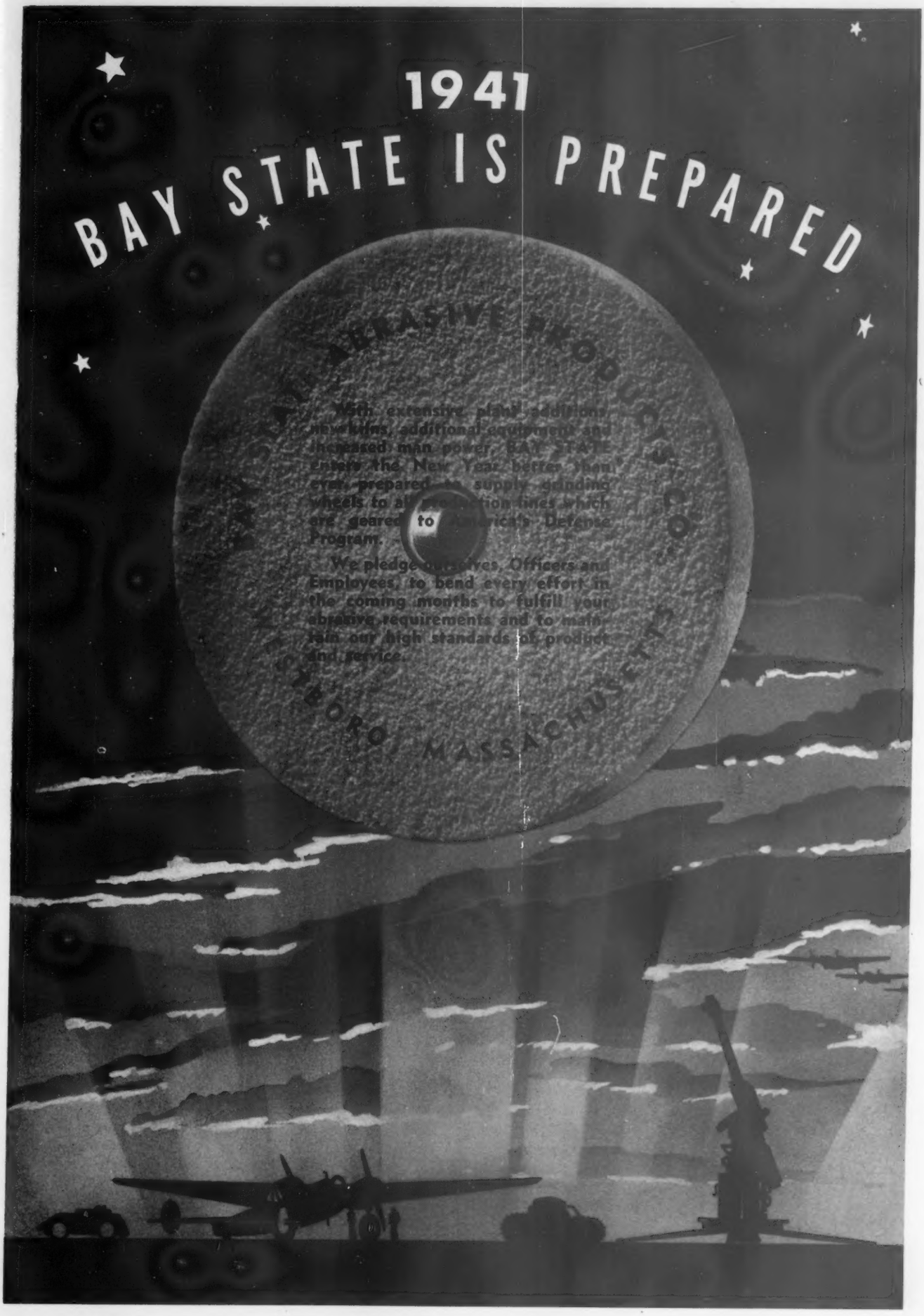
Munition Makers Find Important Advances Made in Nonferrous Metals Since 1914-18

BY H. P. CROFT
Chief Metallurgist, Cleveland Plant
Chase Brass & Copper Co. Inc.

■ IMPROVEMENT in copper alloys in the last two decades is being noted particularly by manufacturers who made munition parts from nonferrous materials in 1914-18 and who are again starting similar work, without having used copper alloys in the meantime. Cartridge case manufacturers find that they can eliminate one or more drawing operations and anneals from their 1918 practice due to the improvements in cartridge brass. Rotating bands heretofore made from copper tubing and turned to length laboriously on a lathe or cut-off machine are now made from a stronger gilding metal alloy containing copper 90 per cent, zinc 10 per cent, and cut to length quickly on improved saws. Fuse parts made during the last emergency by complicated combinations of hot or cold fabricating and machining are now extruded or forged practically to size. Due largely to closer control of mixtures and tempers, threaded sections formerly turned on lathes or automatic screw machines can now be roll threaded, thereby minimizing scrap losses. Coined sections previously made with two or three blows are now stamped to size at one crack—the result of heavier and better designed equipment.

The narrow temper ranges now available are due largely to improved annealing-furnace controls and to new methods for measuring temper. During the last war, the brinell test was standard for temper determinations and grain size was just being introduced. The use of the metallurgical microscope and other methods for quick determination of grain size together with the introduction of the rockwell hardness and similar rapid testers have extended laboratory control to the mill without interrupting or slowing down normal production processes. Too, closer dimensional tolerances result from better engineering design and heavier equipment, the use of 4-high mills, improved bearings and harder tool materials such as chromium plated steel and tungstetn carbide.

One of the more promising of recently introduced alloys, antimonial Admiralty tubing, has been put in use to the extent of 5,000,000 pounds without a single report of tube failure from dezincification. A small amount of antimony, phosphorus or arsenic, nominally 0.05 per cent, has been found effective in preventing the heretofore common type of failure of Admiralty metal. Nickel aluminum bronze, an age-hardening alloy that resists corrosion, has been used to the extent of 75,000 pounds for better bars in one mill. Square copper tubes are finding more use as bus bars. Typical is a bus bar formed from 11-inch square copper tubing.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Better Furnace Atmospheres Increase Uniformity of Work

BY C. E. PECK
D-C Generator Engineering
Westinghouse Elect. & Mfg. Co.
East Pittsburgh, Pa.

■ RECENT improvements in furnace atmospheres are finding wide application in defense work. The need for closer control, for uniformity and for high quality of work being heat treated has undoubtedly accelerated the development and application of these atmospheres. One outstanding development is bright hardening of a wide range of alloy carbon steels without oxidation or decarburization using Endogas produced from a fuel gas and containing a large amount of hydrogen and carbon monoxide but extremely small amounts of carbon dioxide and water vapor. This gas is produced cheaply, and first cost of equipment required also is low. The low carbon-dioxide and water-vapor content produces a gas that is nondecarburizing to a wide range of alloy carbon steels. As a result, this gas is being used to bright harden a wide variety of process parts. It helps make aircraft production hardening a reality.

Another improvement finding wide application is electric-furnace tempering of various steels using a protective atmosphere to prevent discoloration or oxidation. Heretofore, practically all tempering work has been done in air. Since several kinds of steel will oxidize or discolor in air, use of a protective atmosphere in tempering eliminates the need for subsequently cleaning the work and results in a better surface finish. Although not new, nitriding has developed rapidly, particularly in aircraft work. Equipments for the process now are capable of producing extremely uniform results. Bell-type electric furnaces with specially designed forced convection heating are particularly suitable.

High Speed Air Recirculation Cuts Warpage in Aircraft Work

BY S. K. OLIVER
Consulting Metallurgist
Los Angeles

■ THE aviation industry is advancing at an unprecedented rate. In less than a year, carbon-steel cutting tools have been replaced by the high-speed steel types, with tantalum and tungsten carbide tools actually breaking ground in many aircraft plants. The important problem, of course, is greater and still greater production. The two important heat-treating problems confronting the aircraft industry are: How to harden and quench aluminum alloy sheet metal parts without warpage. How to obtain a more uniform hardness and structure in tempered steel parts before machining operations.

High-velocity air-recirculating box and conveyor-type furnaces appear to offer best solution to the problem of drastically quenching aluminum alloy without distortion. In the more successful applications, the quenching tank is an integral part of the furnace. This permits shorter quenching cycles than possible with salt bath or conventional box-type furnaces. Too, automatic cycling and quenching of aluminum alloy parts with high-velocity recirculatory air heating result in more uniformly hardened parts and correct, to a great degree, the troublesome problem of warpage.

In ferrous metal work, advances are needed to meet production demands for uniform hardness in the machinable ranges between 28 and 48 rockwell C, inclusive. At the present time cutting feeds and speeds for pretempered metals in the aviation industry are far below those of other industries, probably for lack of suitable equipment. Realizing this fact, more and more aircraft plants are equipping their heat-treating departments with modern controlled-atmosphere furnace equipment.

Present trend in the aircraft industry is toward higher material strength and hardness before machining. Therefore manufacturers of heat-treating equipment and accessories face the problem of reducing still further that ever narrowing limit of furnace uniformity that metallurgists are always discussing. Future processing of ferrous materials demanding uniformity of structure and hardness will require greater use of hardenability characteristics.

Aircraft and Textile Fields Use More Nitrided Parts

BY CARL F. FLOE
Assistant Professor of Physical Metallurgy
Massachusetts Institute of Technology
Cambridge, Mass.

■ ATMOSPHERE control continues to progress. A principal need, where partially burned gases are employed, is some method for quickly determining what action the atmosphere has on the work over the entire heating range. More data on the equilibria between various compositions of gas and the more common compositions of steel would also be extremely useful. A better understanding of the transformations involved in heat treating high-speed steel has resulted from carefully conducted laboratory tests designed to follow the course of the transformations much more accurately and thoroughly than ever before.

The high wear resistance and close tolerances demanded in the modern aircraft motor have led to the use of nitriding for items such as cylinder barrels, gears, fuel pump parts, shafts and clutch parts. Another application now in the experimental stage is the use of nitrided piston rings for both internal combustion engines and pumps. To cut excessive wear of such parts as thread guides, tension guides and spoolheads, the textile industry has found use of nitrided steels for many of these parts largely solves the problem. Because of new fibers and higher operating speeds, such equipment requires a particularly hard wear-resistant surface obtained by a nitriding temperature of 940 degrees Fahr. instead of the common 975 degrees Fahr. This produces a case having a rockwell 15N hardness of 95. Laboratory experiments designed to reduce nitriding cost by decreasing the time necessary are being made, and there is some indication that they will be successful.

Better Handling Ups Heat-Treating Output 400 Per Cent

BY W. G. HAMILTON
Accurate Steel Treating Co.
Chicago

■ DEMANDS of the defense program early in the year were found to involve larger sized pieces of greater weight than we were equipped to handle efficiently. Efforts, therefore, have all been directed toward a more rapid, efficient and safe method of handling parts in and out of the plant, furnaces, quench tanks and draw furnaces. The last was fairly easy. Adequate crane facilities were all that were needed since these are pit-type furnaces.

Another entrance to the plant with a ramp permits un-

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loading work off trucks onto lift truck platforms at same level. Work then is held on these platforms until furnaces are available, saving extra handling. After heat treating, the work is again loaded on platforms and stored on a cement runway until loaded on a truck direct from the same platforms.

Box-type furnaces, 8 feet long or more, are not easily loaded or unloaded. Shoving work across a fire brick hearth at a temperature of 1600 degrees is a back-breaking job. Removal is equally difficult. We finally hit upon the idea of building a bench in front of the furnace door wider than the door opening and approximately 3 feet deep. The hearth of the furnace was covered with heat-resisting alloy plates extending clear through the door opening out to the outer edge of the bench. To load, work is set on dollies of heat-resisting alloy by a crane. Dollies are rolled into the furnace on the alloy plates and left there during the heating cycle. Work is then readily rolled out of the furnace still on the dolly.

Trays in the quenching tanks which are lowered and raised by electric power reduce tremendously the handling required over quenching by hand or where the tray must be lifted from the tank after each load.

We have an opportunity now at the end of the year to evaluate the savings effected through these improvements. As result of these improvements, a recent day's shipment was four times the average previous tonnage.

Modified Malleables Offer Exceptional Versatility

BY R. J. COWAN
Consultant
Surface Combustion Corp., Toledo, O.

■ THE search for materials suitable for the manufacture of armaments has turned attention to the possibilities of malleable cast iron, modified by heat treatment to produce a variety of products. Starting with the extremely hard and brittle metal as cast, it is modified by graphitization or annealing. This operation is halted at that point which produces a metal having the predetermined amount of carbon in the combined and hardenable form, the remaining carbon then being present as temper graphite uniformly distributed throughout the metal matrix. Stopping the process at various points changes the ratio of combined carbon to temper graphite.

Furthermore, the heat treatment may be carried on in a way that will form on the casting an edge whose depth may be varied. This will be extremely hard while underneath there will be a soft cushion of iron practically free from combined carbon but with temper graphite particles dispersed throughout. By quenching from hardening temperature, the edge of such a piece is hardened, the core remaining soft. The core may be strengthened the desired amount by holding at temperature for a predetermined time—this core-strengthening being caused by the dissolving of temper graphite in the iron which requires an appreciable time for its completion.

Pearlitic malleable may be used also for these purposes. This will contain about 0.50 to 0.60 per cent carbon in the combined form. If heated throughout, the entire metal section will harden when quenched, being similar in this respect to homogeneous steel plate, with this difference that fine particles of graphite will be distributed throughout the metal section. This metal may be hardened by selective heating as by induction or flame heating processes.

Materials of this type are well within the range of malleable iron manufacture and require only a modification of the usual annealing cycle. If it be desirable to harden one side of the casting only, this may be done by a selective drawing process.

Increased Stamping and Forming Results from Welding Progress

BY A. J. MOSES
General Manager
Hedges-Walsh-Weidner Div., Combustion Engineering Co. Inc., Chattanooga, Tenn.

■ STRUCTURAL designing appears to remain somewhat static for long periods of time. Then some new development enables designers to make a breach in their old restrictions. Such a breach then brings about a whole train of changes, which require several years in the accomplishment. Industry is now experiencing such a train of advances in stamping and forming.

No specific stamping and forming operation is quite so interesting as the mass shifting to the use of these processes. The development of the many successful welding methods has breached a lot of the old restrictions and led to the greatly expanded use of stamped or formed sheet or plate structures. While such a transition from the use of castings and forgings has been going on for several years, marked improvements in stamping, braking and forming equipment are providing special impetus to this shift. From a rather timid start in replacing difficult and expensive castings, the success of each such venture has led to stupendous capital expenditures in forming equipment, which, in turn, have broadened immensely the applicability of this method of construction. It now ranges from thin strip of a few thousandths of an inch in thickness to plates 5 or 6 inches thick and weighing many tons.

For example, the desirability of higher steam pressures in the generation of power was an incentive to the development of satisfactory welding methods. These, in turn, permitted the use of heavy formed plates in manufacturing boiler drums. The forming equipment necessary for this work makes available an economical method of replacing expensive forgings of many types. Such equipment, capable of cold or hot forming the heaviest and largest plates now being manufactured, is leading to the substitution of hollow cylindrical or other shaped structures for hollow and solid forgings at much less cost and in much less fabricating time. In fact, welding and plate forming have brought about an avalanche of changes in design, which bid fair to continue at an accelerated rate for several years to come.

New 9600-Cycle Energy Source To Aid Induction Heating

BY R. M. CHERRY
Industrial Department
General Electric Co., Schenectady, N. Y.

■ AN OUTSTANDING development during 1940 was a new compact motor-generator-type frequency changer with a 9600-cycle output for induction heating work. It is an air-cooled 2-unit 2-bearing machine with motor frame bolted to the generator frame and arranged for mounting inside the case of the heat-treating machine. The 320-pole 3600-revolution-per-minute, 9600-cycle generator has an output of 80 kilowatts at 100 per cent power factor; the 2-pole induction motor is rated 145 horsepower. Similar machines with 40 and 60-kilowatt output are also built. The 2-bearing design in the 2-unit machine eliminates coupling alignment and makes the equipment portable since no special foundation is required.

A new line of gas-carburizing furnaces developed during

the past year use propane as a source of carbon and are of the vertical cylindrical-retort type, a motor-driven fan circulating the atmosphere. Drycolene, a new protective-atmosphere gas for heat treating steels without decarburization was also produced. It analyzes 78 per cent nitrogen, 20 per cent carbon monoxide and 2 per cent hydrogen. The atmosphere producer, a gas-heated unit containing an alloy retort filled with charcoal, consumes hydrocarbon gases to heat the charcoal to a high temperature. Products of combustion are cooled to remove moisture and passed through incandescent carbon for the final reactions. The effluent gas, Drycolene, is then used as a protective atmosphere to prevent both scaling and decarburization.

A new immersion heater has its control switch mounted in the end cap to eliminate switch boxes and panels, thus simplifying installation. An improved method of sealing Calrod units against moisture is now perfected, using a Mycalex compound to produce a mechanical seal that withstands 8 hours' immersion in water. Too, longitudinal dimensions can be increased to provide a long creepage path between live terminal and Calrod sheath. A similar seal was applied to cartridge units.

Prefinished Metals Available In Wider, Longer Coils and With Better Surface Finish

BY CARL C. STRUEVER
General Manager
American Nickeloid Co., Peru, Ill.

■ WHILE no new prefinished metals were developed in 1940, methods and processes have been improved to give better prefinished metals—particularly the B and C grades, steel base, sheets and coils, introduced in 1939. Now prefinished nickel steel, chrome steel and copper steel are available in coils up to 24 inches wide. The finish on these has improved to such an extent that many new fields have been opened during the past year.

As a result of continually striving to widen the scope of these products, a new pattern in prefinished metals has been developed this year, termed "oval crimp." This pattern is available in two widths—⅛ and 3/16-inch—in long, continuous coils. The rounded contour of the crimp makes it very adaptable to the inlay field. It is now being used exensively for metal inlays in plastic or wood.

New Porcelain Enamels Use No Antimony, Have High Quantity

BY J. E. HANSEN
Director of Service
Ferro Enamel Corp., Cleveland

■ THE past year has seen the last of imports from Germany of Vallendar clay—and it has seen the comparatively easy changeover in the enameling industry to various domestic clays, particularly to purified blends of domestic clays. New zircon-type enamels containing no antimony develop high reflectance values and assure us of high quality white enamels in the event that supplies of antimony compounds are restricted. Such restrictions might possibly be invoked since antimony is listed as a strategic material by the War department. These new zircon-type enamels are being used by a large number of enameling plants.

Expansion into new fields shows the increasing commercial possibilities of porcelain finishes. One company was organized specifically for the purpose of manufacturing and selling enameled industrial roofing and hot water tanks. Another is producing enameled hot water tanks for one of the large national retailing outlets. Power transformers with porcelain enameled tanks are being offered by one manufacturer at no extra cost over that for transformers with painted tanks. Several other manufacturers are watching developments carefully and plan on offering similar enameled products soon.

Architects and builders are becoming more familiar with the durability, beauty, versatility and color possibilities of porcelain on steel and are specifying more and more of it in their work. Some little flurry due to the national defense program is anticipated. Several plants already have orders for enameled parts for large refrigerators, hospital ware and similar items.

Brass-on-Aluminum Plating Process Affords Sure Means for Anchoring Rubber

BY RAYMOND F. YATES
Vice President
Krome-Alume Inc., Lockport, N. Y.

■ UNTIL about six months ago, it was utterly impossible to plate aluminum with metals that must be deposited from cyanide solutions as aluminum has always been unduly sensitive to cyanide in plating processes. New processes, however, now permit such good protective metals as zinc and cadmium to be deposited directly on aluminum without the intervening layer of nickel necessary in the past. Naturally this greatly reduces the cost of plating aluminum, at the same time affording an excellent protection to the aluminum surfaces. Not only this, but these metals also plate very rapidly and therefore are cheap to use as a covering over aluminum.

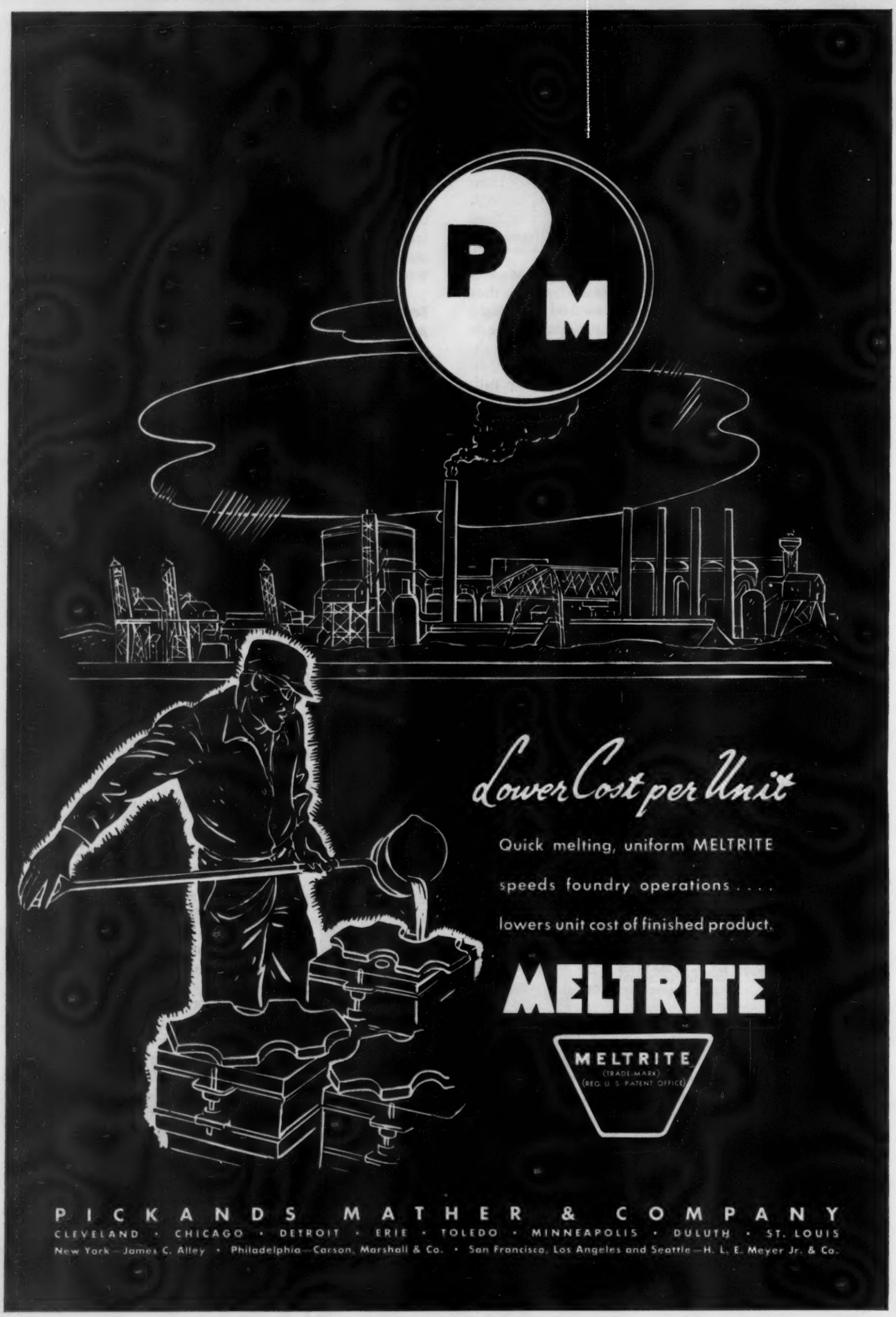
Brass and silver may also be applied directly to aluminum from a cyanide solution. Several very interesting applications of brass are being made at the present time. For instance, when brass is plated directly on aluminum, the brass may be left to oxidize to give a very durable and beautiful surface. On the other hand, brass-covered aluminum becomes available for direct application of rubber, giving increased tensile strength to adhesives used for tieing aluminum to rubber. Already, a number of important applications of rubber-covered aluminum are being made.

Porcelain Enamel Proves Cheap Coating Over 10-Year Period

BY LAWRENCE BLAZEY
Secretary and Design Director
Designers for Industry Inc., Cleveland

■ NEW automobiles with their large gleaming areas of bright chromium plate demonstrate two significant facts in the finishing of metals: First, improved purity of nickel and chromium salts and simplification of steps through which they are processed as well as more scientific means of surface deposit and control gives a better and more desirable finish. Second a copious amount of flashy eye-appeal helps promote sales and create a "pride of ownership" psychology —a great determining factor in the design of a product. The designer relies a great deal upon metal finishing and placting to carry out color harmony and flash to complete a well-proportioned design theme. Mere application of paint on metal is not enough for it must have durability, texture, pattern, color harmony and be fade-proof.

Paint costs have about been revolutionized by the synthetic plastics and resins giving greater durability. Manufacturers are still inventing new textures for baked paint finishes and we shall see more varieties. In plating, white chromium is an important new finish. Permanent color


P M
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Quick melting, uniform MELTRITE
speeds foundry operations . . . .
lowers unit cost of finished product.
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MELTRITE
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developed in the steel itself is bound to appear. It will open up a vast field for color co-ordination.

Porcelain enamel as a protection and finish is expanding but considerable improvement is still possible in the colors and textures used. Great strides are being made in the building industry in using porcelain enamel finishes instead of paint. I feel that the huge field of modern architecture in homes has, as yet, been untouched in employing the use of porcelain enamel for a permanent exterior and interior finish. Figured over a 10-year period, it is actually one of the cheapest possible finishes since it never becomes blackened or soiled.

Zinc Continues to Contribute To Field of Metal Finishes

BY E. A. ANDERSON
Chief, Metal Section, Research Division
New Jersey Zinc Co., Palmerton, Pa.

■ IN THE field of plating on zinc, this year has represented a period of consolidation and expansion of the developments of previous years, particularly in the use of bright nickel plating methods. Additional progress has been made toward standard specifications for thickness of coating. Attention has been given the development of better methods of cleaning zinc prior to plating. A new method of depositing bright copper was announced.

Advances in organic finishing have continued. Finishes requiring only short time baking at high temperatures have received additional attention. Chemical pre-treatment to improve adhesion has become standard practice in many industries.

The use of zinc dust and zinc oxide paints over galvanized surfaces has received increased attention. Steel producers have continued their active interest in the development and use of methods of producing heavy ductile zinc coatings on steel. There has been a substantial increase in interest in sprayed zinc coatings for the protection of large structures. An improved spray gun operating with zinc powder and an improved zinc powder are now available.

The application of chromate films on zinc to minimize water corrosion has continued to expand. Of particular interest is the use of these films on zinc coated steel containers in the oil industry. Widespread interest has also been expressed in zinc chromate pigmented paints for use on uncoated steel.

New Galvanizing Blanket Cuts Heat and Zinc Oxide Losses

BY W. H. SPOWERS JR.
Consulting Engineer
551 Fifth Avenue, New York

■ AN IMPORTANT improvement in galvanizing is a new material which forms a perfect fluid blanket when placed on the surface of zinc, thus effectively preventing the contact of air and so eliminating the formation of costly oxides. This material may be drossed through, zinc may be fed through it, wire and pipe may be threaded through it without in the least disturbing the continuity of the blanket. The material has a remarkable ability to prevent radiation of heat from the surface of the bath and so effects tremendous economies in fuel. As zinc oxide contains 70 per cent zinc and grows continuously, it is difficult to prevent its formation by use of dry material.

I have records in my office indicating the accumulation of over one million pounds of zinc skimmings or oxides on one pipe kettle in one year. Representing, as this does, a 70 per cent zinc loss with a very small dollar recovery, this one pipe kettle can well suffer a loss of $20,000 to $25,000 a year from formation of oxides which may effectively be prevented by this liquid blanket. Wire kettles are particularly affected by this loss as large exposed areas accumulate great quantities of oxides which must be removed at each drossing period. The use of a liquid blanket of this kind permits the insertion of the dross ladle and the removal of the dross through it without the usual oxide accumulation, the blanket tending to keep a complete coverage during this operation.

Also there is a lowering of the percentage of dross with this blanket because if heat radiation is prevented, less heat need be forced through the side walls of the kettle and thus less dross is formed. All in all, this appears quite the most important development in galvanizing, the last year.

Lead Paints Feature Improved Resistance to Corrosion

BY GEORGE DIEHLMAN
Research Laboratories
National Lead Co., Brooklyn, N. Y.

■ THE FINISH most generally utilized for fabricated steel is a paint primer in which the pigment or solid portion is red lead. This pigment, long recognized for its outstanding corrosion inhibitive properties, has been further improved by recent advances in processing which impart greater fineness and consequently more surface area to combat the forces of corrosion.

The vehicles or liquid portions of paints have been advanced greatly not only in improved properties for the better known drying oils and varnishes but also in the development of synthetic resins which constitute a large part of the solid portion of many varnishes. Because of its relative newness, the synthetic resin field offers considerable opportunity for exploration and new developments may be expected. Since the drying time of paint films is almost entirely dependent upon the composition of the vehicle, it is possible to obtain drying periods from a few minutes to several hours. This ability to control drying time is extremely important—particularly at present—since production schedules must be stepped up to conform to our national defense program.

There is a definite trend toward use of green and other colors for finish or top coats on bridges, water tanks and similar structures. Such paints are most effectively pigmented with white lead which can be tinted readily to obtain color harmony with the surrounding objects. Too, white lead has been considerably improved in general properties such as fineness, hiding power, compatability with paint vehicles and durability. White lead paints having various drying rates can be obtained by proper selection of the vehicle. As a result, modern lead-pigmented paints are more effective than ever in combating corrosion.

Develops "Double Boiler" Galvanizing Pots, Transparent Coating for Zinc

BY WALLACE G. IMHOFF
President
Wallace G. Imhoff Co., Vineland, N. J.

■ FOR years, white or zinc rust has been an extremely vexing and costly problem for the galvanizing industry. The appearance this year of a product called Miccrolac protective coating No. 71 makes it possible to "place zinc coatings in cellophane" like toys and cigars. This protective coating is water-white it is so clear; is applied by a simple dipping process, cold; is very thin and absolutely transpar-

ent; dries exceptionally fast. Sulfur dioxide, sunlight, moisture, oil, grease, gasoline and chemical fumes do not appear to affect it, and it does not blush even in the most humid conditions. It comes ready for use, requires no thinner and is perfectly adapted in simplicity of application for use in all hot-dip galvanizing plants.

Many examples have been noted to show that the presence of tin is not entirely the reason for short life in water tanks in which high tin values have been found. Further research may reveal that in one field tin is harmful, whereas in another it is not.

A new development is use of graphite pipe and fittings to heat pickling solutions of hydrofluoric and nitric acids. They resist the corrosive action of all acids, alkalies and salt solution except those of a highly oxidizing character. The Glenn L. Martin Co., aircraft builder, has installed a "double boiler" zinc pot in which the galvanizing pot is heated by placing it in a larger pot of molten lead which does not attack iron, thus lengthening life of the galvanizing pot. A large sheet galvanizing plant in Argentina, South America, also has been using this type of sheet galvanizing pot for a number of years. Whether this new heating method will now be enlarged in use remains to be seen.

Zinc Plating Direct from Ore or By-Products Will Decrease Load on Zinc Smelters

BY C. W. YERGER
Vice President
Hanson-Van Winkle-Munning Co.,
Matawan, N. J.

■ BECAUSE of the importance of nickel plating, an outstanding development in finishing metals has been in a flowable and easily buffable nickel deposit rather than the bright deposits which were so outstanding for the past few years. This type of nickel cuts cost of buffing and finishing because the base metal does not have to be brought to a high finish, and the necessary slight buffing of the soft nickel eliminates any defects in the base metal.

To conserve metals, rapid progress is being made in an electrogalvanizing process for plating zinc from materials such as sal skimmings and other by-products of the hot-tinning industry, as well as plating directly from the ore. This will reduce considerably the load on the smelted zinc capacity of the country. In addition, considerable savings in tin can be made by electrolytic tin in place of hot-dipped tin because the plated deposits are approximately one-third the weight of the hot-tin deposits. Also, there is a possibility of plating tin strip on one side only for certain tin can applications for even further savings.

There has been a trend toward use of nickel-chromium deposits for utility rather than finish, and there is a possibility that this type of deposit may replace some tin.

Anodic Cleaning Proves a Boon To Many Metalworking Plants

BY E. C. RINKER
Technical Department
Oakite Products Inc., New York

■ AMONG recent improvements in metal cleaning is the development of improved alkaline materials used as electrocleaners. These materials are designed primarily to remove all types of oils, greases, polishing compounds, abrasives and carbon smut in one operation. The work is cleaned by racking or suspending the work in these highly alkaline hot solutions where it then is exposed to high current densities. The work is generally cleaned anodically although in some instances the work is alternately exposed to direct (cathodic) and reverse (anodic) electrocleaning. The time may vary from ½ to 3 minutes, depending on the shape of the article and type of dirt to be removed. This method of cleaning eliminates the necessity of precleaning such as degreasing, scrubbing, swabbing or machine cleaning. It is particularly suited to cleaning cold-rolled steel previous to bright electrodeposits of nickel, cobalt nickel, zinc, cadmium and copper, where the last trace of carbon smut or other microscopic particles interferes with or detracts from the bright uniform electroplate. Although anodic cleaning is primarily for ferrous metals, its use is not confined to these metals. Copper and zinc alloys as well as zinc-base diecastings are now being cleaned anodically. Metal plants find it of greater advantage than cathodic cleaning.

Melamine Resin Finishes Extend The Range of Baking Schedules

BY HAROLD E. KENNEDY
Technical Service Staff, Organic Chemicals Div., American Cyanamid & Chemical Corp., New York

■ A MOST important advance in industrial finishes for steel and other metals is the introduction of resins made from melamine to supplant urea-formaldehyde resins or to extend the ranges of baking schedules required by the latter resins. Urea-formaldehyde resins were best adapted to a minimum baking temperature of 250 degrees Fahr. and a maximum of 325 degrees Fahr. The melamine resins broaden this range from temperatures below 200 degrees Fahr. to as high as 375 or 400 degrees Fahr. at no sacrifice in gloss and color retention. Thus they are much more desirable for stove finishes and elsewhere to meet conditions of high heat in service. Too, the low baking temperatures allow the use of steam-heated ovens. High temperatures allow baking under infra-red or other means of heating which, if not carefully controlled, often discolor the older types of finishes.

Along with this development, alkyd resins used in baking enamels to modify the urea-formaldehyde or melamine resins have been improved to give even better adhesion, gloss and color retention in white and light tints. Similarly, alkyd resins used in air drying or baking finishes for exterior exposure now give better drying speed and other important characteristics. Present trends indicate progress toward producing enamels of greater hardness and drying speed than ever before. These organic coatings, easily applied, are gradually approaching the qualities of porcelain.

Composite Electroplates Give Unusually Effective Coatings

BY ROBERT J. McKAY
Chemical Engineer
International Nickel Co. Inc., New York

■ FOR both nonmetallic and metallic coats, the tendency is toward more accurately fitting the coating to the service. Another trend is to closer specification of the finish and composition of base metal as illustrated by recent improvements in hot-dipped tin plate through control of the steel base. New long-lasting vehicles for paints and lacquers have appeared, and pigments are being used more scientifically.

Advances in metal coatings are apparent in electroplating and metal cladding as electrodes can now be made

to compare in physical properties with furnace-melted metal, and positive control can produce the highest degree of corrosion resistance—as in electrogalvanizing. New proprietary composite coatings are being plated to exact thickness specifications with subsquent heat treatment to minimize porosity effects and to give unusual corrosion resistance. Of these, a zinc-on-nickel coating has attracted much attention and has gone into production this year. Promises of equally interesting tin-on-nickel have been made.

Continuous plating of strip for later fabrication is increasing. Large metal producers are more seriously considering low-cost electroplating of rolled strip and shapes, and pilot plants of new design have been built. The processes are high speed, involving current densities in the hundreds and even thousands of amperes per square foot with plating periods of only a few seconds. Speed seems limited only by the ability to handle the heavy currents.

Nickel and, to a certain extent, copper are spreading as heavy builtup coatings in addition to hard chromium plate for wear and corrosion resistance. "Bright" plating of all principal metals is now commonplace and has lowered finishing costs. Several types of clad metals have been improved by new processes including stainless clad, high-nickel alloys, aluminum and platinum clad. Platinum-clad sheets and other shapes are making this precious metal more practical, too.

Pictures Increased Use of Unit-Load-Pallet Handling

BY C. D. EILER
Secretary-Treasurer
Crescent Truck Co., Lebanon, Pa.

■ THE MATERIALS handling industry has made great strides in meeting the demands placed upon it by the all important defense program. The electric truck industry, with which I am most familiar, has developed many new methods to speed the handling of all classes of material in every manufacturing process.

Possibly most important of these is what is known as the unit-load system handling groups of various sized objects on double-faced wooden pallets by means of fork trucks. When such a unit is steel strapped to the pallet, it provides an efficient package for movement between plant departments, through storage and for shipping. Economies resulting are often of surprising magnitude.

Thus the pallet method of commodity handling with the electric fork trucks is outstanding in modern industry, and I believe this method will be almost universally adopted in the very near future.

Corrugated Steel Handling Accessories Prove Valuable

BY W. B. LACKEY JR.
Secretary
Service Caster & Truck Co., Albion, Mich.

■ NO LONGER are modern floor trucks, trailers, skid platforms and pallets constructed of wood or with wooden decks and superstructures. Material handling equipment designers only recently have discovered that light sheet steel, 16 to 12 gage, corrugated at intervals of about 3 inches, then braced with another lengthwise corrugation at right angles will withstand many times the weight which could possibly be taken by a wooden plank from 1 to 2 inches thick.

Moreover, corrugated sheet metal eliminates all splintering, warping and breakage. For instance, pallets made of corrugated sheet steel will easily resist the brutal jamming and impact from motorized fork trucks as well as wear from the daily shock and grind of heavy industrial work. Strangest of all, corrugated steel equipment in most cases actually weighs less than the wood and steel type it replaces. Too, it is unaffected by standing loads. It cannot sag, shrink or buckle due to atmospheric conditions.

Light but cunningly reinforced steel parts solidly fused together by modern arc welding contribute greatly toward solving the age-old replacement problem. More, it has reduced the status of material handling equipment from that of a costly "necessary evil" to a "cost-saving" necessity.

Improved Handling Equipment Helps Prevent Bottlenecks In Steel Production

BY N. L. DAVIS
Sales Manager
Link-Belt Co., Chicago

■ DEFENSE measures are probably more definitely reflected by the steel industry than any other with the possible exception of the chemical munitions industry. In steel, increased production means more closely correlated handling from one operation to the next and on to completely processed steel. Thus to reduce handling costs and to speed up production, a most vital contribution from the materials handling industry to the steel industry has been the development of conveyors for handling coils of hot-strip to permit proper cooling and to facilitate storage.

Research also has developed more durable and dependable chain designs for hot-strip transfers, pipe-cooling conveyors, slab-transfer tables, conveyors for handling crop ends from hot slabs, steel-scrap conveyors, etc. New and better conveyor chains also have been developed and used in continuous reheating ovens.

The art of handling materials mechanically and transmitting power efficiently is developing fast in the steel industry as a result of the new problems with which steel mills are constantly being faced and the co-operative work being done by both equipment makers and users.

Unit-Load Handling Solves Many Difficult Problems

BY ADOLF LARSEN
Vice President in Charge of Sales
Gerrard Co. Inc., Chicago

■ DURING the year 1940, one innovation in the materials-handling branch of industry which likely heralds more to come was the shipment of materials and manufactured products on pallets or skids. Previously most such items were shipped in individual corrugated boxes at considerable expense for handling as well as for the package material. In addition, numerous handlings and countings were involved in shipping and receiving these individual items.

Contrast this with the new method wherein a number of such items as motors and self-starters are simply steel strapped to a single wood pallet or skid with no covering other than an occasional sheet of wrapping paper. Being firmly strapped under tension to the pallet or skid so that they are rigid and tight, these unit loads are easily moved by lift truck in and out of the freight car or of automobile trucks. Such widely differing products as sound deadening material in sheets and light bulbs in cartons are handled this way. The light bulbs, protected by corrugat-

ed boxes but without dividers or reinforcing of any kind, are packed on skids with merely several galvanized high-tensile wires strapping them to their base.

This method of materials handling is just beginning. It has tremendous cost-saving potentialities. We can foresee now the handling of thousands of more products in this manner within the next year. The equipment to carry out this method is neither costly nor expensive to operate. Large volume manufacturers will be first to adopt it. They in turn will be followed by smaller manufacturers as they become more familiar with the possibilities offered.

Stacking Loads on Pallets Is Efficient Way To Increase A Plant's Storage Capacity

BY F. J. SHEPARD JR.
Treasurer
Lewis-Shepard Sales Corp., Watertown, Mass.

■ CONSTANTLY increasing wage rates are forcing manufacturers, warehouse men and common carriers to invest in more efficient materials handling equipment in an effort to hold costs in check. The lift truck and skid platform system offers a low-cost installation that eliminates rehandling and makes it possible to move larger unit loads. Special lift trucks that will pick up machines or piles of pig directly from the floor are an important development.

The current necessity of utilizing every available cubic foot of storage space to stock increasing inventories has greatly increased the demand for portable elevators or stackers which permit piling to any desired height in stock rooms and warehouses. In many installations, it is possible to stack skid or pallet loads without rehandling. Floor trucks with specially designed superstructures to handle specified products are increasing in demand—especially where finished parts are handled. Special wood-lined tray and shelf-type trucks are typical.

The rearmament program has created a demand for spark-proof materials handling equipment—and a recent development is a grounded Celeron floor-protective wheel that prevents static. Truck bodies of bronze and aluminum in combination with wood are a recent development for loading plants.

Small Fork Trucks Now Permit Efficient Handling Methods In Multi-Story Plants

BY H. J. BEATTIE
Supervisor, Material Handling
General Electric Co., Schenectady, N. Y.

■ FROM a plant operator's standpoint, the outstanding advance in materials handling methods during recent years is the advent of unit package shipments. Each year unit loads are finding wider applications, and it is just a matter of time until they will be universally adopted for carload and truck shipments as well as less-than-carload shipments.

Improvements in material handling methods generally are the result of improvements in mechanical handling equipment. Fork trucks, for instance, account for the success of the unit packaging method. Until about a year ago, unit-load fork-truck handling was limited largely to main floors because floor constructions in many buildings would not permit the concentrated weight of the heavy fork trucks. Late in 1939, the truck manufacturers put on the market lightweight fork trucks, approximately 2½ feet wide by 4 feet long, that can handle loads up to 2000 pounds, extending fork-truck handling to upper floors of multi-storied buildings and so permitting 100 per cent adoption of the fork-truck-pallet method.

Quick acceptance of this device is evidenced by use of 146 fork trucks in the General Electric plants alone—42 of these being the small lightweight units. Program for 1941 includes study of how to use these trucks more in work-in-process operations. It will involve development of special forks, tote boxes, racks, etc. The tiering feature of the trucks has been found indispensable for saving much-needed floor space.

A recent development worthy of note is a new design of hydraulic hoist mounted on a truck tractor for dumping semitrailers. In its Bridgeport, Conn., works, General Electric has 10 large underslung semitrailers of 24-cubic-yard capacity serviced by one truck-tractor equipped with a hoisting mechanism and used for handling shop refuse, corrugated cartons, paper, wood, etc., to the incinerator.

"Streamlining" Conveyors and Supports Cuts Dust Buildup

BY W. HUME LOGAN JR.
Treasurer
Logan Co., Louisville, Ky.

■ WELDED construction for conveyors, in preference to rivets or bolts has gained great impetus in recent months—both for heavy and light equipment. Hexagon shafts for roller conveyor are now being used almost exclusively, particularly on heavy-duty conveyors.

Another significant trend is the increased "streamlining" of conveyors, frames and supports, especially for plants where cleanliness and neatness are observed to a marked extent as new modern streamlined designs tend to eliminate dust crevices in the conveyor frames and supports, thus contributing to a better general appearance of plant interiors. There is also a tendency toward use of dust shields over roll ends of ball-bearing conveyor rolls, with no lubrication being used whatever.

Diesel Locomotive Cranes Step Up Speeds, Offer Economies

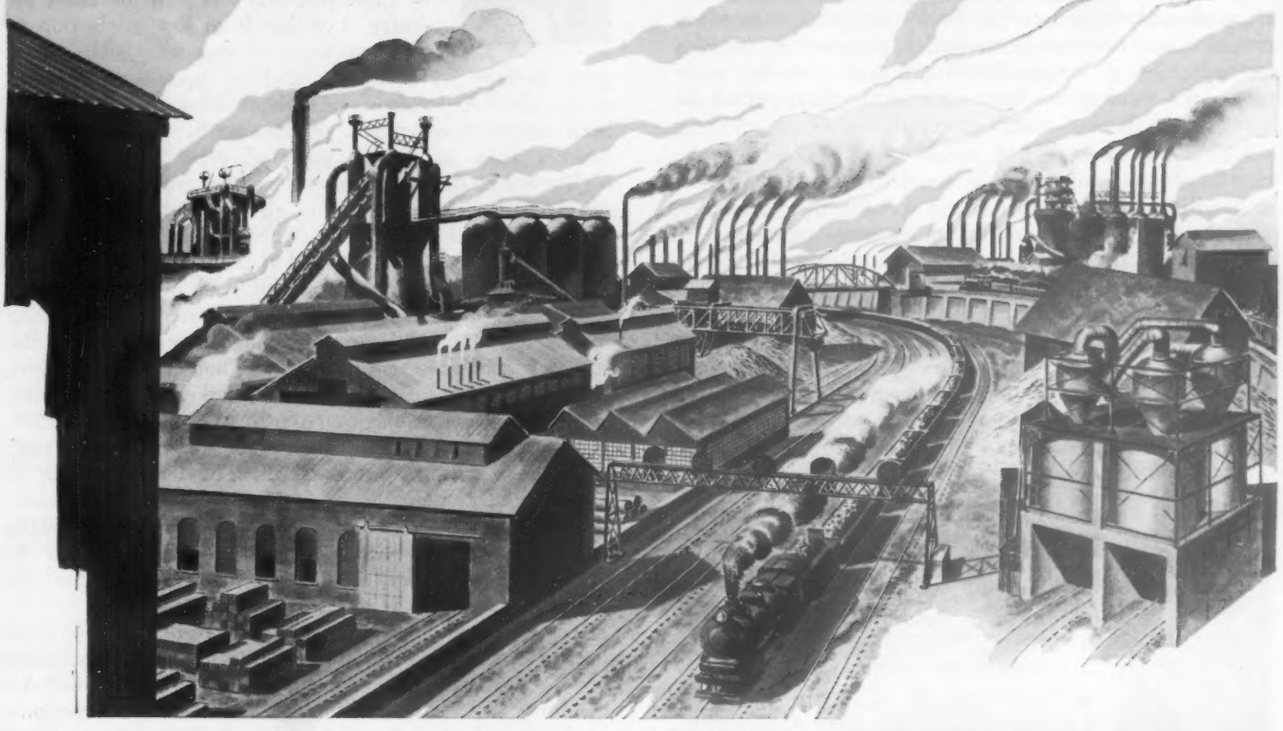
BY HOYT E. HAYES
President
Industrial Brownhoist Corp., Bay City, Mich.

■ THE ADVENT of the compact modern diesel engine has stepped up substantially the efficiency of the locomotive crane, one of the important material handling units in steel plants. Such diesel locomotive cranes burn but 2 to 2½ gallons of inexpensive fuel oil per hour, representing an interesting saving over coal or coke. Engine maintenance averages less than that required on a steam crane boiler. The fireman has been eliminated, as well as hostler service at night. The usual 1½ to 2 hours lost time per shift filling water tanks is now added to the crane's availability.

Fuel supply lasts several shifts and refueling is done with little or no interruption to service. Work done is not limited by the steaming capacity as full power is always available. Thus travel speeds are more than doubled, alone a great time saver in a large plant.

The new monitor type cab, offered for the first time this year, gives operator the full 360-degree vision now possible when there is no boiler to obstruct his view. Modern air-operated power controls allow operator to maintain high speeds continuously without fatigue. These features are sure to decrease accidents substantially.

America speeds up



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Welding Speeds Shipbuilding: Permits Straight-Line Assembly Of Position-Welded Subassemblies

BY GEORGE F. WOLFE
Chairman, Welding Committee
Dravo Corp., Pittsburgh

■ PRACTICALLY unused a decade ago, welding today is rapidly becoming the backbone of every industry. Airplanes, ships, gun mounts, tanks, trucks, in fact almost every article entering into the defense program is welded in whole or in part. To obtain the full benefits of positioned welding and maximum economy of construction in shipbuilding, large shop assemblies are made and shipped out for final erection to yards where provision has been made to utilize straight-line assembly methods. These, coupled with the fact that the larger part of the welding has been done in the shop, permit delivery of the finished vessels in record time.

Welding in shipbuilding involves the ability to make very large preassemblies at the erection site. The necessity of handling these heavy loads and spotting them accurately into their place in the ship requires more modern crane equipment than has hitherto been available. One of the most recent developments has been the production of all-welded traveling gantry cranes with screw luffing to provide extreme accuracy in setting heavy loads in position. At present, a large number of these cranes are under construction with 150-foot booms of special triangular design and with low-alloy steel chords for units rated 28 tons at 85-foot radius on the main hook and 7½ tons out to 160-foot radius on the whip line.

Production Puts Emphasis on Completely Integrated Handling

BY H. T. FLORENCE
General Manager
Cleveland Crane & Engineering Co.,
Wickliffe, O.

■ THE greatly increased production brought about by the defense program has caused practically all branches of industry to examine carefully their materials-handling methods. In an effort to find means of increasing efficiency, management is giving overhead materials handling more attention. While materials handling systems of all types have had a rapid growth in the last 15 years, certain trends have been established. One of these is toward complete systems rather than individual handling units. This is particularly true with light loads. This shift has been well under way for some few years, but within the last year complete systems have been much more definitely in demand. Production schemes today require all units of production to be so routed that they can be picked up at the first stage of production and completed with little or no rehandling.

Monorail handling is toward automatic systems. Installations are being made where the work is picked up and conveyed automatically to remote locations in the plant with no one accompanying it. A great variety of these systems handle almost every conceivable type of product with automatic carriers, automatic elevators, inclined trackages, lift sections, and so on. Of course efficiency and production have been materially increased and costs reduced by these systems.

Overhead traveling-crane handling equipment likewise shows improved performance. The all-welded crane with rigid one-piece girders, trolley frame and end trucks, permitting rigid bases and permanent alignment for the precision roller bearings, has permitted higher speeds. Today it is not unusual for large capacity cranes of 120-foot span to handle loads at bridge speeds of 600 and 700 feet per minute whereas a few years ago 300 feet per minute was considered quite fast. Production managers want and get equipment that will handle larger loads, larger units of production at higher speeds, with minimum rehandling.

All-Welded Construction Is Now Found on Many Traveling Cranes

BY B. VAN HORN
Manager, Crane Sales Dept.
Harnischfeger Corp., Milwaukee

■ THE past year has seen the crane industry skyrocket from low production to overflow capacity, due primarily to the great demand for materials handling equipment involved in the defense program. Although crane deliveries have been extended somewhat, cranes can be produced much quicker than in former years of great demand. Such highly accelerated production is made possible by extensive use of welding on crane girders, end trucks, trolley sides and the like. Welded construction for box-type crane bridge girders has been adopted as the standard by the majority of crane builders after several years of careful investigation, successful experiments and thorough tests of shop technique. The welded crane girder has proved one of the strongest and most rigid possible. Though of less weight, there is no sacrifice of high-grade workmanship or finish. The fish-belly form of girder is still used wherever possible to eliminate excess dead weight and to obtain the most refined "streamlined" appearance. The lighter weight of an all-welded crane appreciably reduces the wheel loads, thus allowing somewhat larger capacity cranes on existing runways. The adoption of full-roller-bearing cranes by the industry, together with welded construction provides further economies in power requirements.

The past year has seen added emphasis on safety of crane operators and men on the floor. Full-vision type cages have contributed much, particularly those with front-lever-operated controllers with controllers themselves mounted in the rear of cabs. Since only the pipe-like operating levers are in front, full vision is afforded the operator. Since higher production scales demand greater speeds for overhead traveling cranes as well as more delicate or precise speed regulation, we look forward to seeing all overhead traveling cranes equipped with full magnetic control because such control, though greater in initial cost, reduces manual effort and lowers cost of maintenance.

Mass Production Principles Essential in Defense Work

BY W. V. CASGRAIN
Mechanical Handling Systems Inc.
Detroit

■ RAPID and efficient development of an adequate national defense is a job of tremendous magnitude that calls for the utilization of the most modern and up-to-date methods of mass production and materials handling. Many industries heretofore on a limited production basis have suddenly been flooded with orders. Existing mass producers, too, have been given added work. The answers to the production problems involved must be drawn from the vast experiences gained over the past quarter century in the development of American mass production technique.

While the automobile plant is the outstanding example of this development, it is by no means the only one. There are many others in a variety of industries, for the range

of application of mass production *principles* is unlimited. Many manufacturers think of mass production technique only in terms of a conveyorized assembly line and reject the whole idea for themselves on the theory that their business is "different" or that "you can't build my product the way you build an automobile."

That sort of thinking is a danger to the rapid and efficient development of our defense program. *The facts are that the principles of mass production technique are basic and can be applied to every volume production problem.* Manufacturers generally must distinguish between these principles and some specific application of materials handling that they may have in mind which might lead them to reject the idea as unsuitable to themselves.

Larger Truck Batteries and Better Handling Facilities Feature the Year 1940

BY GEORGE E. STRINGFELLOW
Vice President and Division Manager
Thomas A. Edison Inc., West Orange, N. J.

■ AMONG the principal advances in industrial truck storage batteries during the year 1940 were: Introduction of the D-type high-capacity battery; development of steel cradles in which the batteries are assembled at the factory. The D-type batteries, first shipments of which were made early this year, provide more capacity in proportion to the area of the battery compartment than ever before. They were developed primarily as a result of the increasing use of industrial trucks in limited clearances, especially for power carloading.

The assembly of industrial truck batteries in steel cradles at the factory has been a result of the increasing use of industrial trucks in schedules of 12 to 24 hours a day, which in turn requires assemblies that can conveniently be exchanged in the truck so one battery may be on charge while another is in operation. In some cases, the trucks are designed so the battery as well as the battery compartment is exchanged as a single unit. Batteries for such trucks are now assembled in demountable steel boxes at the factory—another new development.

New Alloys Permit Conveyors To Operate at 1600° Fahr.

BY NIXON W. ELMER
Engineer
Stephens-Adamson Mfg. Co., Chicago

■ SEVENTEEN years ago at the Frick mine we installed 80,000 precision antifriction bearings on five miles of underground belt conveyor. These belts have carried coal at the rate of 11,000 tons every eight hours, two shifts a day ever since. With the knowledge and consent of their engineers we sealed these bearings on one section, so they could never be greased after the initial factory greasing. In 17 years' double-shift operation, only 5 per cent of the bearings have been replaced and, up to my last information, none among the sealed bearings.

Thus the idea developed of sealing bearings for life at the factory, which is now done by the tens of thousands. In wet conditions, as in phosphate pebble washing plants in Florida; all truss frame belt idlers are equipped with sealed bearings in which both the outside and the inside, including the balls and races, have been Pentrate treated for rust protection. One of the large users of these sealed bearings tells us that the saving in greasing labor and grease pays for the bearings every four years.

Another recent development is the conveying of bauxite from a kiln at 1100 to 1500 degrees Fahr. The moving element is made of high chromium-nickel alloy. A similar conveyor is now being built to operate at 1600°F.

Easily Adjustable Scale Dial Aids Automatic Coke Weighing

BY E. W. SCHELLENTRAGER
Vice President
Atlas Car & Mfg. Co., Cleveland

■ ON BLAST furnace stockhouse scale cars, dependability of operation and ease of accessibility for inspection and repairs are stressed. Decided improvements have been made along these lines during the past year. The same thought applies to quenching cars for by-product coke oven service. In these, a new type of dependable operating mechanism has been developed, which is more simple and direct than previous types. It eliminates a number of shafts, bearings, cranks and other parts in the interest of dependability and reduced maintenance. A new type of cast floor plate for quenching car service is also being tried out.

Perhaps the greatest improvement is in scale dials for automatic coke weighing for blast furnace skip pits. A new dial is arranged so the tripping point is instantly adjustable from outside of the instrument by simply turning a knob on the face of the dial. When so adjusted, it controls the automatic weighing with extreme accuracy.

Unit Loads on Skids Can Cut Your Manufacturing Costs

BY J. G. BUCUSS
Sales Manager
Acme Steel Co., Chicago

■ PERHAPS the first use of the skid idea was the adoption by man of a form of support or protection to his feet. Today, the sheet, tin plate and strip departments of the steel industry are possibly the largest users of skid packaging. Recipients of these products soon found how to bring about economies through their own use of this method. First was the reduction in the cost of unloading the cars. Second was moving the skids directly from the car to the specific machine that would fabricate the sheet, tin plate or strip into a finished product with only one handling. In addition, the carload shipments of these products assured arrival at destination without damage.

Possibly the next industry which was quick to adopt the skid idea with similar advantages was the paper industry. Now the skid idea has been acceptetd and placed in use for moving such products as zinc anodes, pigs of lead and many other raw materials. It has possibilities for almost every manufacturer.

The automotive industry also was quick to recognize the potential saving and protection afforded the products shipped by the skid method and has adopted it for such products as small motors, bumpers, leather, oil filters, steering gears, mufflers, axles, wheel frames, springs, transmission units, universal joints, radiators and lumber.

The cost of adopting a one-way non-returnable skid pallet can be figured at approximately one cent per inch of the squared dimensions of the skid or pallet. The cost of applying the flat steel bands to maintain the products on the pallets is negligible in comparison with the economies that can be effected through standardizing the number of pieces placed on the pallet and the elimination of additional packing materials that would be needed if those same pieces were shipped as individual units. Further study

of production and its related problems and use of skid packaging will continue to make greater progress in effecting handling economies.

Ram and Fork Truck Capacities Now Range from ½ to 15 Tons

BY D. L. DARNELL
Sales Manager
Baker-Raulang Co., Cleveland

■ OPPORTUNITIES for greater production and lower costs are more easily found in the handling of materials than at any other point in the manufacturing system. Therefore, the most important problem now facing the industrial truck industry is to step up shipments to equal the demand resulting from the rearmament program. Since delivery is of prime importance, special designs are being waived in view of faster deliveries on standards.

During 1940, several trucks of interest to steel mills were developed—a 10,000-pound vertical lift bosh truck; a 20,000-pound center-control ram truck; and two 20,000-pound articulated sheet handlers, one for waster sheets and the other for handling polished auto body sheets without scratching. Of general interest are the new 2-ton elevating and high lift trucks designed for operation in narrow aisles and congested areas and suitable for tinplate handling. No startling new developments appear in sight. Like those mentioned, new models are more a refinement of existing designs. The center-control ram and fork trucks which represented a major advance back in 1935 have been refined and models designed for capacities all the way from the 1000-pound midget to the 30,000-pound giant.

Super Lifting Magnets Do the Job Faster, More Reliably

BY F. W. JESSOP
President
Ohio Electric Mfg. Co., Cleveland

■ THIS year has seen the practical application of real super lifting magnets. Two double-strength 65-inch diameter magnets are used by a large steel mill to handle rough coils off the hot mill and coils after pickling to stock on cars or trucks. These double-strength magnets lift unfailingly and never drop even the roughest coils. One of these magnets tested out on plate scrap and on plate trimmings lifted over double the average load for a standard 65-inch magnet.

At another mill a super strength 55-inch magnet works regularly all day loading and unloading heat-treating pits containing billets from 4 x 4-inch by 20 feet up to large billets weighing over 12,000 pounds. The hot lifts range from 400 to 700 degrees Fahr. Formerly this work took twice as much time and they had to spell off two standard 55-inch magnets every half hour to keep the job going. The main point in favor of such super strength magnets for certain jobs lies in the fact that they can do the job faster and more reliably, cut labor costs and crane time.

Trends and Developments in Steelmaking Emphasize Influence of the Defense Program

BY F. B. POTO
Mill Representative,
Inland Steel Co., East Chicago, Ind.

■ UNDER pressure of defense program and a realization of our needs in obtaining greater steel production, impetus was given during 1940 to a study of the means available to that end. While no revolutionary changes have taken place in continuous sheet mills, some thought has been given to increasing the speed of older mills, and to the development of better finishing machines and processes. More cooling sprays have been applied, and special types of steel developed to meet severe metallurgical requirements.

A greater tendency in the use of coils instead of sheets to save scrap has been noted and the top weight of coils demanded has steadily increased. Experiments in electrolytic tin plating and steam blueing have been made, and greater use of these processes is anticipated, and especially the former because of the necessity of conserving our tin supply. Simplification of specification to eliminate those varying from standard by only a minor degree and those developed to meet customer's special practice, would operate beneficially to obtain the greater effective production. Another brake on production is the small order items. In many cases this condition could be improved by ordering against future needs, and in those of medium tonnage requirements by allocating a given size and gage to one mill instead of splitting it among several mills.

Monorail Handling Systems Go To Greater Capacity

BY H. M. MILLER
President
American MonoRail Co., Cleveland

■ SO GREAT has been the surge of defense orders, plus other orders that our employment has risen 126 per cent in the past year. We are now operating three shifts and wrestling with the problem of how to secure skilled and semi-skilled labor. Increased business necessitated additional operating floor space now provided by plant addition, adding 20 per cent to the factory area.

The rapid and increasing call on the part of industry for safe methods for handling heavier loads at greater speeds has resulted in outstanding improvements in overhead handling systems. For example, a recent development is a line of overhead tracks, carriers and cranes with complete mechanization for power and remote movements—all of 5-ton capacity. Sales of this line have increased steadily so now almost 40 per cent of our output is for load capacities from 3 to 5 tons.

The monorail industry anticipates greater recognition of the highly specialized nature of our product, and the very real assistance our research and engineering departments make available for the solution of defense production problems in practically any plant.

New Steel-Heating Furnace Offers Important Possibilities

BY P. M. OFFILL
Vice President
Amsler-Morton Co., Pittsburgh

■ DEVELOPMENT of alloy steel has been rapid during the past few years and is now greatly expanding the scope of its use. Unquestionably we are only on the threshold of an expansion whose trend is obvious and whose future is promising. The process of the growth of an idea or trend is necessarily slow, and is done cautiously so as not to interfere with normal production. Existing tools and equipment are generally used. Development of ideas and products are retarded by the use of obsolescent tools. Much harm is done by an inability or a refusal to recognize the limited

NATIONAL CARBON GRAPHITE KARBATE PRODUCTS

TRADE-MARK

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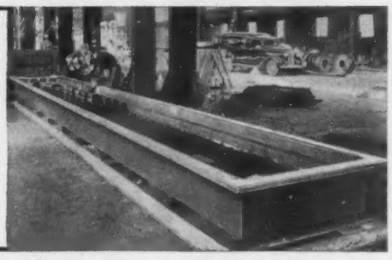
Reduce Losses

FROM CORROSION, THERMAL SHOCK AND CONTAMINATION OF PRODUCT

● Carbon, Graphite and "Karbate" products are highly resistant to the action of most acids, alkalies and other corrosive liquids and gases. They possess good mechanical strength and exceptional resistance to thermal shock.

"Karbate" is a brand of material, of carbon or graphite base, which is impervious to the seepage of fluids under pressure. Graphite and "Karbate" No. 2 have high thermal conductivity and excellent heat transfer properties.

CONSTRUCTION MATERIALS

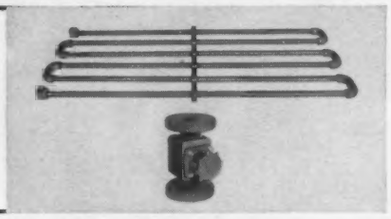


Carbon and Graphite Brick, Flat Tile, Blocks, Beams and other structural shapes are used for the construction or lining of many types of processing equipment because of their high resistance to corrosion and their ability to resist the destructive effects of severe thermal shock. Graphite construction materials are used where high thermal conductivity is needed.

Carbon is used with excellent results for lining

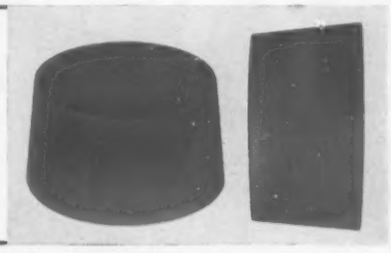
PICKLING TANKS • DESULPHURIZING LADLES • BLAST FURNACES

PIPE, VALVES AND FITTINGS



Carbon, Graphite and "Karbate" pipe and fittings are available in sizes from ½ inch to 6 inches I.D. Saunders type valves of "Karbate" construction are also available. These corrosion resistant products are used for the construction of drain lines, heating coils — both steam and gas-flame types, and other types of conveying, circulating and heat exchange equipment. Carbon or "Karbate" No. 1 is recommended where high heat transfer properties are not desired. Graphite and "Karbate" No. 2 pipe have heat transfer properties equal to steel pipe of corresponding I.D. Plain Carbon and Graphite pipe and fittings are sufficiently impervious to convey fluids at low pressure without disturbing seepage. Graphite pipe heat exchangers are being used to heat corrosive baths with low pressure steam and eliminate the dilution resulting from injection of steam in the bath. At higher pressures, or where all seepage must be prevented, "Karbate" materials are recommended.

CARBON INGOT MOLD PLUGS



The use of Carbon Mold Plugs in alloy steel ingot molds eliminates ceramic inclusions and resulting loss of ingots. It also prevents contamination of the scrap obtained from the cropped ingot ends. With correct use, carbon plugs can each be used for several pourings.

CARBON RASCHIG RINGS

Carbon Raschig Rings provide an efficient and economical packing material for gas scrubbing towers. They are mechanically strong and highly resistant to both the thermal shock and the corrosive materials encountered in this service. Their low weight per unit of volume reduces cost of tower construction.

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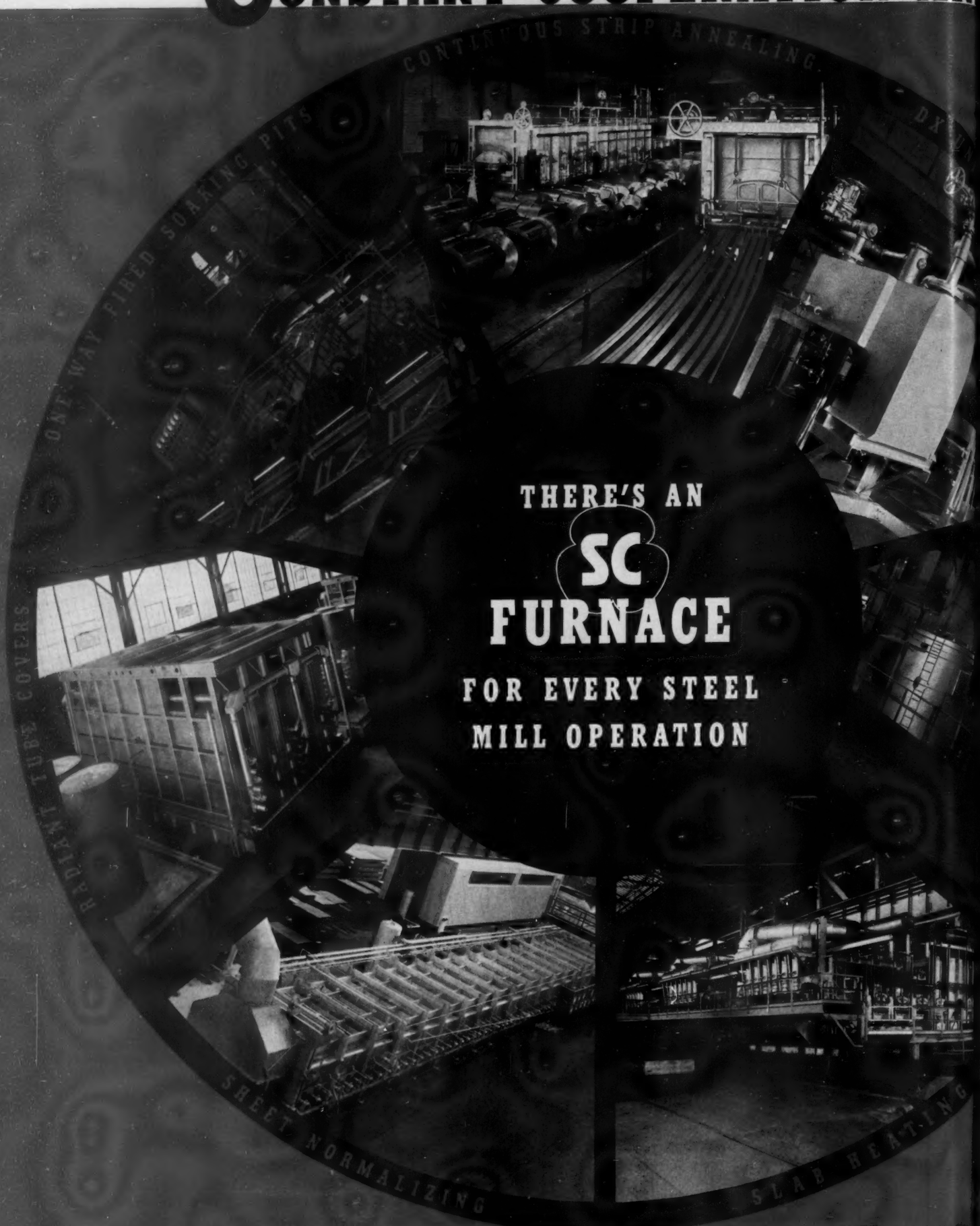

AN ONTACT WITH THE STEEL MILL FOR

34 YEARS

Only a few short years after the organization of Surface Combustion in 1907 . . . the steel industry was called upon to meet the demands of the first World War. Even then Surface Combustion, through close cooperation with the industry, was able to make numerous important contributions in the design of new furnaces. Outstanding SC developments and installations of that period included what was then the largest continuous furnace for treating 76 mm. shells; the rotary shell nosing furnace; and the direct fired vertical or pit type gun furnace . . . Today, the steel industry is again called upon to meet another emergency. With a background of 34 years of experience and literally thousands of installations in the steel mills, Surface Combustion can now offer immeasurably greater help to the steel industry with its heating and heat treating problems.

Shown at the left are a few typical and recent SC installations. Among the more prominent other types of furnaces developed by SC but not shown are: The walking beam conveyor furnace for heating round billets for piercing into tubing; tube treating furnaces; galvanizing settings, utilizing the SC developed radiant impact burners; continuous shell treating furnaces with walking beam conveyors; and the Char-Mo Atmosphere gas generator for protecting high carbon and alloy steels . . . In short . . . there is an SC furnace for every Steel Mill operation from the time the ingot solidifies to the final heat application.

SURFACE COMBUSTION CORPORATION • TOLEDO, OHIO

"SECURITY FOR AMERICA"

SC FURNACES FOR NATIONAL DEFENSE

WHEREVER HEAT IS USED IN INDUSTRY

SURFACE SC COMBUSTION

34 YEARS

MANUFACTURERS OF INDUSTRIAL FURNACES • JANITROL GAS-FIRED SPACE HEATING EQUIPMENT • AND KATHABAR AIR CONDITIONING SYSTEMS

sphere of usefulness of existing tools or the necessity of creating new tools. The apron strings of tradition are responsible for many delays and troubles, but the use of new tools push out existing frontiers.

Creation of a new steel-heating furnace that has pushed aside yesterday's ideas of a modern furnace has brought to light a method of heating that has achieved a quality of heating heretofore rarely obtainable. It has made possible increased production in the same floor space, and reduced heating time; also there are considerable fuel, labor and maintenance economies. Above all, it has made available a furnace that anticipates the present and future needs of the steel industry for the quality heating that is definitely required, particularly for alloy steels.

Tandem Cold Strip Mill Has Top Speed of 3850 Feet

BY L. A. UMANSKY
Assistant Manager
Industrial Engineering Dept.
General Electric Co., Schenectady, N. Y.

■ TWO pioneer hot strip mills were widened and their rolling speed radically raised during 1940. These changes involved the use of bigger motors, more converting capacity, modernization of switchgear, and improvements in auxiliary drives. On one of these mills two 3500-kilowatt, 600-volt mercury arc rectifiers will be used to supplement the three 3000-kilowatt motor-generators now installed; this will be the first American installation of rectifiers for main roll drives. While a rolling speed of 2100 feet per minute in cold strip rolling was considered an upper limit a year ago, a tandem mill with a top speed of over 2500 feet per minute was put in service in 1940, and a mill with a maximum delivery speed of 3850 feet per minute was ordered.

A notable improvement was made in the control of flying shears used on continuous hot-strip mills. Heretofore these shears were connected to the last mill stand. The new control provides a purely electrical tie between the mill and the shear, eliminating the mechanical tie yet maintaining as good or better accuracy of the cut. Electronic regulator and an amplidyne exciter were employed successfully. A photoelectric width gage was built for measuring "on the fly" the width of a hot strip traveling at high-speed. This width is measured and indicated with an accuracy of better than ⅛-inch, in spite of the somewhat wavering movement of the strip. In this manner the operator can maintain a continuous check on the strip width, and can correct at once for any deviations.

Stripmakers Increase Width And Speed of Early Mills

BY C. L. McGRANAHAN
Assistant General Superintendent
Jones & Laughlin Steel Corp., Pittsburgh

■ MODERNIZATION of earlier broad strip mills by widening and by materially increasing delivery speeds has characterized 1940 developments. Full advantage has been taken of improvements in heating furnaces, antifriction bearings, table and coiler design, electrical control, and of pyrometric equipment at points hitherto considered unnecessary. Finishing departments have undergone a revamping in order to handle wider sheets, as well as new products made possible by the increased width and greater hot rolling capacity.

Design of the front fender of the modern pleasure car has placed an additional burden upon the sheet manufacturer due to the severity of the drawing operations. This problem is being met by close metallurgical control, starting in open hearth and following through to the finished product where suitability is determined by a microscopic examination of the grain size in addition to the usual rockwell and Olsen values.

The trend from cold-rolled sheets to sheets in coils has become marked, and this year, no doubt, will see at least 50 per cent of the cold rolled sheet requirements made in this form. The practicability of the method of fabrication from coils rather than sheets has led to a demand for heavier weight coils with the result that most of the strip mills are faced with a large expenditure for equipment to handle the increased outside diameters and greater weights.

Replacement of hot-rolled tin plate capacity by cold-reducing methods continues and mills with speeds between 3500 to 4000 feet per minute are in order. As in the case of the hot strip mill, existing cold-reducing mills have had their speeds increased as much as 100 per cent. Most tin plate manufacturers who are expanding their facilities contemplate using existing tinning equipment even if located at some distance away rather than install new machinery. This condition is brought about by the uncertainty of the tin supply and to the possibility of the developments of lacquers and coatings which might supplant tin.

Furnace Efficiency Improved Greatly by New Instruments

BY M. J. BRADLEY
Market Extension Division
Leeds & Northrup Co., Philadelphia

■ INCREASE in ingot production per unit of present producing capacity is one of the most outstanding advances in the steel industry. This is the result of immediate demand of approximately 80,000,000 tons annually. This production is being accomplished by more efficient operations. Quality of steel produced has improved steadily with improvements in efficiency as well as an increase in output.

Demand for efficiency has created a need to measure and control operating conditions by scientific instruments rather than by experience and practical methods. This is especially true in the cases of reversing, furnace pressure, and combustion control. Combustion control, or metering the quantities of fuel and combustion air to the furnace, is being used to control flame conditions within the furnace. At present investigation is being carried on to determine the effects of flame conditions on the temperature of flame, heat input to bath and chemical reactions taking place in bath. These investigations may lead to control of combustion conditions regulated from flame conditions.

Immersion pyrometers are being used to measure the temperature of molten metal during the finishing of the heat and before tapping. Their use is important because chemical reactions taking place in the bath are associated with temperature conditions and so temperature data supply a guide for working and finishing the heat to meet definite specifications.

Develops New Radiant Tube Furnace for Annealing Strip Steel and Wire

BY J. L. WHITTEN
Sales Manager
Lee Wilson Engineering Co., Cleveland

■ IN OCTOBER and November of 1940 the first two installations of an entirely different type of radiant tube application were completed, one in the strip and one in the wire industry. This new design consists of placing the

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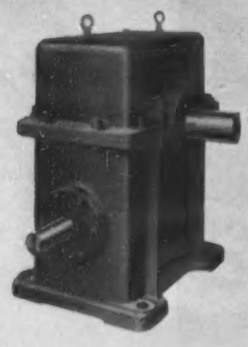
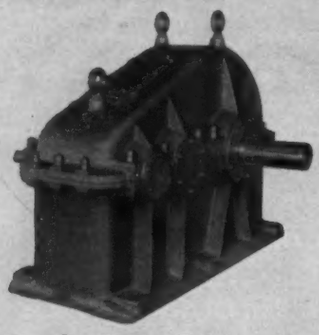
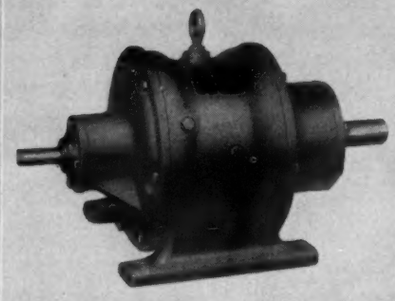


Heavy Duty Worm Gear Reducer
Horizontal Drive
Ratios 6 to 65:1 1/8 to 150 H. P.

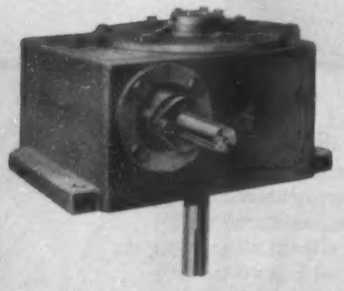


Continuous Tooth Herringbone Reducer
Single, Double or Triple
Ratios 2 to 350:1 1 to 800 H. P.



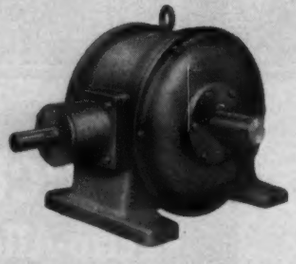
Planetary Gear Reducer
Horizontal or Vertical Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.

Right Angle Spiral Bevel-Planetary Redu
Horizontal Drive
Ratios 8 to 1200:1 3/4 to 50 H.

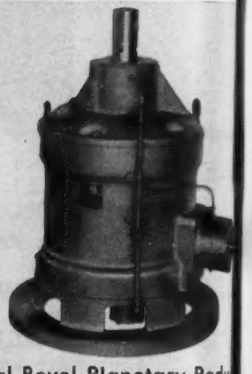


Heavy Duty Worm Gear Reducer
Vertical Drive
Ratios 6 to 65:1 1/8 to 150 H. P.

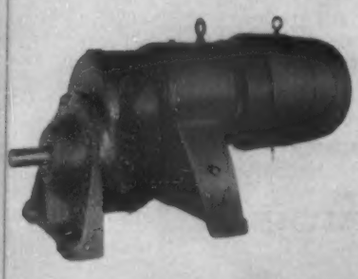
Right Angle Spiral Bevel-Herringbone Reducer
Ratios 6 to 45:1 2 to 250 H. P.



Right Angle Spiral Bevel Gear Reducer
Horizontal or Vertical Drive
Ratios 1 to 6:1 3 to 275 H. P.



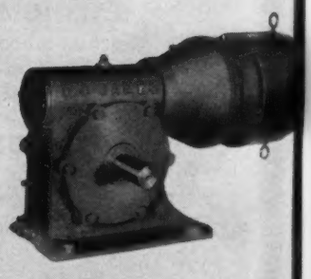
Spiral Bevel Planetary Redu
Vertical Drive
Ratios 8 to 1200:1 3/4 to 50 H.



Motorized Helical Reducer
Horizontal or Vertical Drive
Ratios 1.2 to 9:1 3/4 to 50 H. P.

Motorized Planetary Reducer
Horizontal Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.

Motorized Planetary Reducer
Vertical Drive
Ratios 4 to 1200:1 3/4 to 75 H. P.



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firing tubes within the inner cover to be an integral part of it and to release their radiant energy directly to the charge instead of having to drive it through a retort shell as formerly. The waste gases instead of being discharged directly to the atmosphere, are now discharged within the furnace bell so that they provide heat to compensate for the radiation losses of the furnace. The recirculated gases in the circular furnaces pass directly over the source of heat in the tubes, and since the location of the tubes will cause considerable turbulence, heat transfer is improved.

In effect, this new design makes every inner cover a furnace. The furnace bell is no longer a furnace but only a heat retainer and for that reason is inexpensive. If the cycles require slow cooling under a furnace, the production of the unit is not limited because an inexpensive second furnace bell can be used to start firing a second charge while the first one is cooling under its bell. Among the advantages of this unit is the ability for extremely fast cooling by blowing air through the firing tubes. The additional cooling thus effected assures the adequacy of three bases per unit with a corresponding reduction in cost and floor space. Actual results from the first units in operation show an immediate fuel reduction of 10 to 15 per cent, and an increase in production of 10 to 15 per cent in low-carbon strip and wire installations.

A dual pressure burner can be adjusted with micrometer accuracy to produce exactly the length of flame desired in the firing tubes in this new unit which are vertical in position but are U-shaped so that the tube makes a complete bend before it discharges its gases at the bottom.

Forging Presses Developed To New High in Efficiency

BY JOHN L. YOUNG
Manager, Machinery Sales
United Engineering & Foundry Co., Pittsburgh

■ OUR national defense program has rejuvenated the development of forging presses, both large and small for making the many types of forgings for such an emergency. Large presses are required to make the necessary armor plate, and other essential forgings which go into heavy construction, and the lighter presses are principally required for the making of shells, and bombs. Steam hydraulic forging presses served this country well during the last conflict, and those same presses are still carrying on during the present emergency, but as armor plate has become bigger, thicker and tougher, bigger and stronger presses are required to meet the needs of our present requirements.

During the intervening years, the pure hydraulic press has been developed with rapid strides. Now shell piercing and forming presses have reached a new high in efficiency and productivity, with ratings up to 300 shells per hour. A further development makes shell forgings complete in one operation.

Research Committee Studies Mechanics of Rolling

BY GEORGE B. KARELITZ
Department of Engineering
Columbia University, New York

■ FURTHER advance was made in the investigation of the mechanics of rolling, the subject being studied by an ASME research committee on rolling of steel. The plastic property of steel at high temperatures was studied and the mechanics of lubrication of cold-strip rolls investigated. Rolling pressures are high, and the lubricant might be well solidified even at the temperature which exists at the rolls.

Difficulties have been encountered in computing the time-temperature curves for transient heat flow phenomena, such as the rate of heating or cooling of billets, or the heat penetration into metal from a weld. An electric model for obtaining time temperature curves is now installed at Columbia university engineering school. Tests show that this is a practical method for solving problems in transient heat flow, which can be used to advantage by those interested in this phase of steel manufacture. The setup allows to contract (or extend) the periods of long (or short) duration temperature fluctuations into a predetermined period of several minutes, comfortable for observation and recording.

Strict Requirements Call for Narrow Range of Analyses

BY J. L. GREGG
Research Engineer
Bethlehem Steel Co., Bethlehem, Pa.

■ THE INTERNATIONAL situation has brought about a sharp increase in steel plant operation with a large percentage of increased production consisting of grades of steel having strict requirements. It is therefore essential to produce steels, the chemical analyses and physical properties of which lie within narrow ranges, and to be able to do so consistently. Desulfurization and other methods for producing more uniform hot metal will aid open-hearth operations. However, it is up to the open-hearth personnel to smooth out all irregularities in the charge and produce steel within the limits prescribed for phosphorus and sulfur, and in such a condition that the final deoxidation will be efficient. The present interest in slag control shows there is a desire to take advantage of all possible methods for controlling the uniformity and increasing the efficiency of open-hearth practice.

Rapid spectrographic analyses have proven their worth where low incidental alloy limits must be maintained for certain grades of steel because they make it possible to divert heats while the steel is still in the furnace instead of after the ingots have been rolled. Because of the rapidity with which they can be made, spectrographic analyses have also been found extremely helpful in making alloy steels.

Producers Study Best Methods Of Using Raw Materials

BY GILBERT SOLER
Manager, Research & Mill Metallurgical Dept., Steel and Tube Division, Timken Roller Bearing Co., Canton, O.

■ RELATIVE supply and demand of pig iron and scrap have caused steelmakers to focus their attention on the best methods of utilizing these raw materials. The feasibility of various duplexing and combination furnace operations is being seriously considered. Direct-ore reduction process developments have been revived. Cupola methods for producing hot metal from low-grade scrap are in use in districts close to scrap accumulation centers but comparatively far from pig iron sources.

The strategic position of steelmaking alloys has been widely discussed. Steelmakers have experimented with electrolytic manganese produced from domestic ores, and although the product is satisfactory for use, the price is too high under present production costs to compete with low-carbon ferromanganese. The partial substitution of domestic spiegeleisen and silicospiegel for standard grade ferro-

manganese is being considered. Facilities for production of manganese from domestic ores are being developed.

Chromium is not critical due to the large stock piles of high-grade ore and the reserve supply of domestic deposits. However, an exothermic chromium containing material produced in Canada, utilizing the lower grade ores, is available for chromium additions to the open-hearth ladle. It has been widely used in Canada but its use in the United States has been largely of an experimental nature. Increased attention has been paid to utilizing alloy residuals in scrap and to methods of slag and furnace practice resulting in higher alloy recovery. Balancing of operations so that mill and ingot capacity are properly co-ordinated has uncovered needs for increased equipment or changes in methods of processing. Soaking pits appear as bottlenecks in some districts.

Metallurgists Take Increasingly Important Part in Steelmaking

BY PAUL J. McKIMM
Metallurgist
16503 Dartmouth Ave., Cleveland

■ OPEN-HEARTH practice in the last 20 years has undergone little improvement of a drastic character. Furnaces have been equipped with automatic combustion control, insulation has been adopted rather freely, and sloping backwalls have been installed. But despite these innovations practice remains virtually the same as for the past two decades. While some shops are using a 65 per cent iron charge, others are working quality heats with 40 to 44 per cent iron in the charge. Practically no surface treatment of the steel made with the cheaper charge is necessary. Metallurgical departments are called upon to make heats that require practically no chipping or scarfing.

If cracking of the steel is encountered, a hand-picked higher cost charge will not remedy matters, nor will it explain the nonperformance of the steel. The heat treating and processing must be in line, and for this reason the work of the metallurgist is recognized as one of the essentials of good open-hearth practice.

Open-Hearth Operators Show Interest in Basic Brick

BY W. J. REAGAN
Assistant Open-Hearth Superintendent
Edgewater Steel Co., Oakmont, Pa.

■ CONSIDERABLE interest is being shown by steelmakers in the growing use of basic refractories in open-hearth furnaces. Most of these are chrome base refractories, with combinations of chrome and magnesite available. Furnaces using this type of refractory have been described as operating at much higher than normal temperatures and in one case it was stated that steel was tapped at 3200 to 3300 degrees Fahr. This furnace was of complete basic construction, including roof, sidewalls and bottom and the bare bricks were used as a working bottom. In another case a basic bottom of a 135-ton furnace was heated and burned in, in about 4 days (103 hours). On this same furnace, during a campaign of 267 heats, total bottom delays were only 12 hours and 20 minutes.

An entire new picture of open-hearth operations may be in the making by the use of such refractories and allowing the use of much higher than ordinary temperatures. To make the best use of these refractories and to give maximum tonnage production many changes in furnace design have been made, and in many cases partial bottoms have been installed with plastic refractories that result in a monolithic bottom. In some of the best engineered jobs the interior of the furnace has the appearance of a one-piece chamber, the original design right at the start of a campaign giving that streamlined appearance that is usually obtained over long periods of time when all unnecessary corners, etc., have been melted or eroded away. From such combinations of smart engineering and improved refractories, it is not hard to determine why 170-ton furnaces have been stepped up from an average of 302 tons per day to 395 tons, an increase of 31 per cent. The future seems to indicate even greater increases in tonnage etc.

Accumulates Test Results on Desulphurization of Iron

BY RALPH H. SWEETSER
Consultant
17 Battery Place, New York

■ PROBLEMS confronting blast furnace operators include how to get the most pig iron with the present supply of blast furnace fuel, and what to do with the less desirable coking coals which will have to be used. Answers to these problems perhaps may be found through research work that was undertaken by the blast furnace and raw materials committee of the American Institute of Mining and Metallurgical Engineers. This committee of 29 members is sponsoring two research problems that were authorized in 1940. The first relates to the physical characteristics of blast furnace fuel made in by-product coke ovens.

The second research problem is to find out whether or not the practice of external desulphurization of hot metal with alkali is the answer, not only how to use high-sulphur coke and iron ores, but also how to get more pig iron out of a given blast furnace. Already the demand for maximum production of pig iron has absorbed the entire available output of the by-product coke ovens, and has forced the starting up of several thousand beehive ovens (possibly anthracite will again become a blast furnace fuel). This brings into commercial use some of the higher sulphur and higher ash coking coals which usually slow down the production of furnaces. The desulphurization test has just been completed by the Pittsburgh Steel Co. at Monessen in co-operation with the Solvay Process Co. which furnished the soda ash and the extra chemical and engineering services required. It will take some time to compile and tabulate the data, and to calculate the gains in tonnage and the savings in cost (if any) by using soda ash outside the furnace instead of limestone inside for sulphur removal.

Are Present Steelmaking Facilities Adequate for Our Needs?

BY WILLIAM C. BUELL, JR.
Steel Plant Consultant
Arthur G. McKee & Co., Cleveland

■ SLAG control has advanced to the point of common use whereby steel grades that were extremely difficult and costly of manufacture but a short time ago are now produced on a tonnage basis as a matter of routine. In addition improved refractories and refractories practice have increased the furnace productive life and so have substantially reduced lost time occasioned by rebuilds and running repairs. In the past 10 years, ingot producing capacity has increased by about 12 million tons, or from 70 to 82 million tons. Basic open-hearth capacity represented about 59 million tons 10 years ago. It is about 73 millions at present, an increase of 14 million tons. Thus, 6 million tons of the increase is

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represented by enlargement of furnaces built prior to 1930.

Mr. Tower speaking with the authority of the American Iron and Steel institute, see STEEL (Oct. 14, 1940, page 75) stated that 7 to 8 million tons migh be required for rearmament in 1941, and that the present abnormal exports were at the rate of 12 million tons. Thus, deducting these items there will be 62 million tons still available for domestic use and consumption. Total production for 1940 will approximate 63 million tons, which is about what was produced in 1929 from a capacity rated at less than 72 million tons.

Therefore, giving effect to the remarkable performance of our steelworkers during the past few years and envisioning a material technological advance in the immediate future, we need harbor no fear of the ability of our industry to produce to any extent it may be called upon in order to fulfill any tonnage demands that now appear reasonable.

Heat Treating of Armament Demands Modern Equipment

BY A. L. HOLLINGER
Manager, Steel Mill Sales
Surface Combustion Corp., Toledo, O.

■ NECESSARY transition to modern methods for heat treating heavy armament in one step instead of gradually over a period of 15 to 20 years is a problem facing some mills. Since 1914-18 enormous advance has been made in the development of heat treating equipment and technique. Convection heating, prepared atmospheres, gas carburizing, complete automatic control, etc., have been universally adopted. Whereas the heat treatment of heavy armor plate and forgings has been carried on in a leisurely fashion, directed by heaters of great skill and long experience, the hundred-fold increase in demand requires the adoption of the last 20 years' developments practically overnight. Certainly it cannot be expected that the demand by the armament program, both as to quantity and quality, can be met properly by methods practiced 20 to 25 years ago.

It is hoped that the expanded activity in rearmament does not sidetrack the development and consideration of improvements in our normal steel processing operations. The last of 1940 saw completion of the first commercial dry pickling installation utilizing a gaseous atmosphere of hydrochloric acid (HCL) at elevated temperatures for the descaling or etching of steel products. This installation will be used for the pickling of strip continuously in preparation for coating with zinc or tin. It is expected that continued development will make available a regenerative process which will not only greatly reduce the cost of pickling but answer the waste acid disposal question, too.

Effort Is Made To Increase Yield of By-Product Ovens

BY L. F. REINARTZ
Manager, Middletown Division
American Rolling Mill Co., Middletown, O.

■ MANAGEMENT this year will aim to produce the most tonnage consistent with the quality of the product being manufactured. In the coke plant, experiments are being made to produce good blast furnace fuel on shorter coking cycles. In some plants oil is being sprayed on the coal in an attempt to increase the coke and by-product yields. Blast furnace operations are being speeded up. Many stacks have been enlarged to meet pressing demands for more pig iron. Studies are being made to find out which mixture of ores and so-called cheapeners will produce the most tonnage at a reasonable cost. Several sintering plants have been rehabilitated and now help step up tonnage.

There is a constant urge on the part of the open-hearth superintendent for lower silicon iron for use as hot metal in the open-hearth furnaces. It is important in such practice that the temperature of the metal must be kept up, and sulphur content kept down.

Old open-hearth furnaces have been rebuilt, and managements have been importuned to provide funds so as to be able to purchase equipment to keep melting shops operating at a peak rate for many months. Stockyard congestion, switching delays, pit operations must be watched with an eagle eye to keep all furnaces in a shop in efficient production. Already many shops have operated at a high production rate for a longer period than any time since 1929. Soaking pits have had to stand the brunt of large scale productions. Mills have been operated for many days without weekend shutdowns. More and more cold strip mills are being called upon to manufacture sheets which have, in the past, been made by the hot rolling process.

Quality Control of Products Becomes Prime Requisite

BY J. H. FLAHERTY
Metallurgist
Jones & Laughlin Steel Corp., Pittsburgh

■ TODAY it is necessary to increase production at no sacrifice to quality. Recent additions to electric furnace capacity have filled expanding needs in the higher quality brackets. While there has been some balancing of raw materials and facilities among open-hearth producers to eliminate production bottlenecks, an appreciable tonnage of bessemer capacity is not yet utilized. While rolling cycles and deliveries are lengthening, the industry is meeting current needs.

Defense requirements are necessarily at high-quality levels. Aircraft steels must meet critical magnaflux inspections requiring unusual cleanliness and freedom from flakes, checks and internal seams. Steels to be used for tanks, guns, armor, shells, etc., are subject to critical quality specifications of etch, metallographic, magnetic and other searching inspection tests. Users of steel for domestic purposes have a responsibility to keep their quality specification within the engineering and utilitarian needs of their products, otherwise a heavy and unnecessary toll is taken of steel production and yields through quality competition.

Present Upsurge in Industry Finds Blast Furnaces Ready

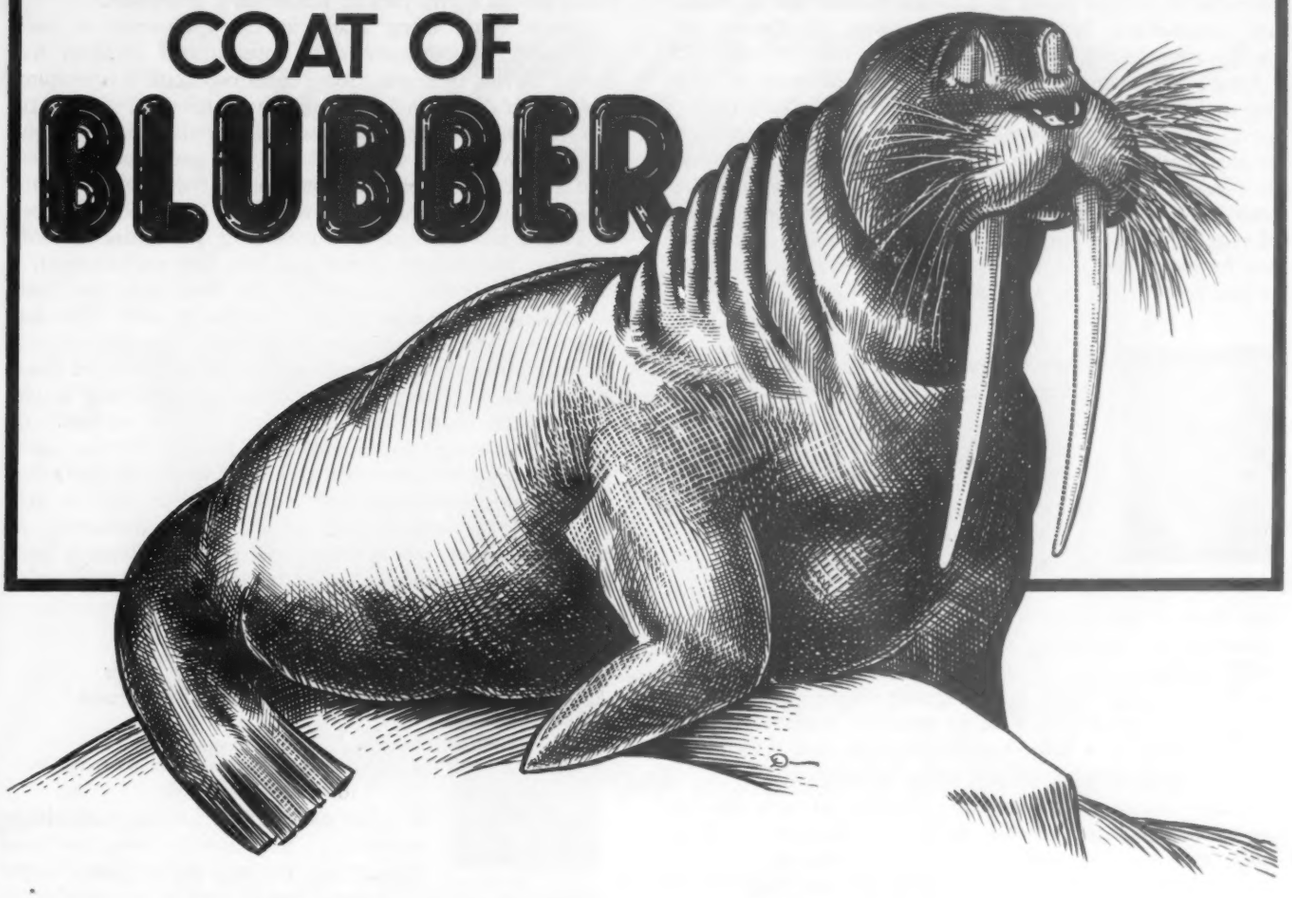
BY H. W. JOHNSON
Superintendent, Blast Furnace Dept.
Inland Steel Co., East Chicago, Ind.

■ MAJOR advance during the decade has been in the ability to build furnaces of over 1000 gross tons daily capacity which operate at high efficiency. The past year has witnessed the operation of a unit larger than any previously built in the United States. The larger units have established the fact permanently that they can be as successful as the smaller units for ordinary grades of iron. The amount of gas available for other metallurgical uses has been increased, with the general use of the high-efficiency small checker stoves. Improvements in measuring and controlling temperature in hot zones, and use of superduty firebrick, have eliminated the one disadvantage of this design.

Need for control in raw materials used to produce iron has been further accepted. The purity and uniformity of coke has been increased by better coal washing installations and facilities to provide a uniform feed to the coke ovens.

THOUGHTS ON POPULAR COATS NO. 8 *By Hanlon-Gregory Galvanizing Co.*

COAT OF BLUBBER



Blubber is defined as a thick layer of fat that covers marine animals. Its chief function, aside from upholstering the beasts, is to keep heat in and cold out. Because a walrus has an elegant coat of blubber, this remarkable creature can air itself on an ice cake in zero weather and never worry about anything except sea-going Esquimau, who like to sneak upon it with the intention of pulling its teeth and peeling off its blubber. After a walrus grows up, it may weigh as much as 1½ tons, counting its protective coating and its two large tusks; it uses these overgrown fangs to dig clams, to haul itself out of the water, and as weapons of offense and defense. Blubber is an efficient coating, and we can't help comparing it with HANLON-GREGORY HOT DIP GALVANIZING. Here is a zinc coating to protect ferrous metals, and whereas an Esquimau can peel the blubber off a walrus in a few minutes with a stone knife, the forces of corrosion can't peel off the protective coating rendered by the H-G HOT DIP PROCESS sooner than three generations.

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AMERICAN HOT DIP GALVANIZERS ASSOCIATION INC.

HANLON-GREGORY GALVANIZING CO.
PITTSBURGH PENNA.

More new installations for screening and sizing coke at blast furnaces have resulted in lower fuel consumption and better control. New commercial units for crushing and sizing ore are being installed. Special equipment has been provided at several plants to decrease fluctuations in chemical composition. Several air conditioning installations are in operation in which some moisture removal is effected.

One of our national problems is the conservation of coking coals. The blast furnace industry is the single largest user, consuming approximately 50,000,000 tons per year, so any development which would result in a small increase in efficiency is important. There is opportunity to make such improvement by additional study on the manufacture of coke so the best possible product is produced consistently and by more study on the flow of gases within the furnace so this product will be used most efficiently.

High-Frequency Generators Adapted to Shellmaking

BY G. E. STOLTZ
Steel Mill Engineer
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

■ ONE of the newest developments in the steel industry in connection with the defense program is the use of high-frequency generators in the manufacture of shells. At present there is in operation a 333-kilowatt 960-cycle motor-generator set for heating shell blanks by induction. Induction heating avoids the formation of a large amount of scale. It is particularly advantageous in the nosing of the shell, as the graduated heating provided tends to prevent the formation of a bulge on the curvature near the straight part of the shell during the upsetting operation.

Large numbers of electric arc melting furnaces also are being installed for defense work. Transformers rated as high as 15,000 kilovolt amperes with accompanying current regulating and switching equipment are required by such furnaces. Voltage surges in electric arc furnace operation usually ranging from four to nine times normal values can be cut in half by the use of surge protective equipment. Tin plate and automobile sheet mill rolling speeds have increased to average 2200 to 2400 feet per minute with maximums as high as 2700 feet per minute. Newer mills are being designed for still higher speeds now made practical by development of what is known as IR drop compensation for the electric motors driving the individual stands. This allows the motors to maintain the same synchronized speed relationship between each other throughout the entire range from full running speed, down to threading speed and so holds normal gage and prevents the strip from breaking. Three tandem mills are now in operation with IR drop compensation and five are in manufacture. This development removes electrical equipment from the list of possible limiting factors restricting cold strip rolling speeds which probably means that we may expect strip to be rolled at still higher speeds soon.

Production Rates Traceable To Modernization Programs

BY C. D. KING
Chairman Open-Hearth and Bessemer Committees, United States Steel Corp. of Delaware, Pittsburgh

■ MODERNIZATION of open-hearth plants during the past decade combined with notable advances made in steelmaking technique have alone made it possible to meet present heavy production demands while complying fully with the continuing stringent steel quality requirements. Slag control, in its many phases, continues to be routine practice at steelmaking plants. Rapid testing methods, such as the carbometer, carbanalyzer, bomb tests for FeO, and many others, typify present steelmaking procedure.

Advances are being made in the application of bath pyrometry. Instrumentation of open-hearth furnaces has grown during the past year including roof temperature, draft regulation, fuel and air proportioning, automatic reversal, and similar apparatus. Improved furnace designs have followed from continued study of gas velocities, pressure and temperature conditions within the furnace system, which combined with intensive efforts to reduce all types of delays has resulted in outstanding production records by many open-hearth plants and low fuel consumption.

Improved process control on the floor side has been accompanied by similar progress on the pit side. This has taken the form of improved ladle design, stopper rigging, pit side refractories and practices, as well as improved pouring facilities. Tilting furnace operation, involving liquid blown metal charges, has come into its own as result of increased tonnage requirements. Advances likewise have been made in bessemer steels. Studies involving controlled temperature of blowing and "end point" as well as steel pouring temperatures, have led to greater uniformity of the bessemer operation. Some noteworthy advances have also been made in dephosphorizing bessemer steel, with increased application of such steels.

Trend in Steelmaking Is To Speed Up Furnace Reactions

BY C. E. SIMS
Supervising Metallurgist
Battelle Memorial Institute, Columbus, O.

■ LOW-SILICON low-sulphur high-temperature iron now is being produced through the use of superhot blast. Larger proportions of this hot metal can be used in an open-hearth charge. Synthetic scrap is being produced in various ways to offset increased demand. Besides regular bessemer duplexing, much blast furnace iron is being blown to eliminate silicon and reduce carbon to about 2.5 per cent before charging as hot metal in the open hearth. In cold melting shops hot blast cupolas are being used or planned to convert steel scrap to hot metal containing about 3 per cent carbon. Ladle desulphurization of pig iron and cast iron with soda ash has been proven so practicable that its use is rapidly increasing. Ladle dephosphorization, more particularly of bessemer blown steel, also is receiving much attention.

In basic open-hearth operation, slag control is more than a by-word, and helps the melter more swiftly and surely to the desired end. Ladle additions for deoxidation or alloying have been used to some extent by nearly all melters. For example, ladle deoxidation in the basic open-hearth process is almost obligatory. But many melters and metallurgists have entertained firm convictions against ladle additions. Others have proven to their own satisfaction that ladle additions, properly used, do not adversely affect the steel quality either as to properties or cleanliness, but do effect a saving in furnace time and in the cost of alloys because of better recovery. Even mold additions have been used.

Alloy producers, recognizing this trend, have marketed lower melting point alloys. The size of ladle additions is limited by their chilling action on the steel, however, and for that reason self-melting, exothermic alloy mixtures that do not reduce the metal temperature have been favorably received and successfully used.

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Nine Cannon Barrels Now Made In Time Formerly Required For a Single Barrel

BY C. T. HARRIS JR.
Brigadier General, Assistant to Chief of Ordnance, Chief of Industrial Service War Department, Washington, D. C.

■ DURING 1940, significant advances were made in machining processes. New and improved machine tools with higher speeds and feeds make it possible to take full advantage of new processes. The combination has resulted in faster and more efficient production of the weapons so necessary in our present defense program. The use of high-speed multi-tool lathes has cut time required for turning gun barrels to one-third of the former figure. Increased speeds of milling machines have made possible the use of carbide-tipped milling cutters. Appreciable time has been saved in numerous operations on breech parts of guns.

One of the most striking examples of progress is indicated by improvements in making breech rings. The breech ring of a gun forms the guide at the back end of the gun in which the breech block slides. After the round of ammunition is inserted, the breech block is moved over completely to seal the breech end of the gun tube. Until recently, the mortise in the breech ring was formed by the use of a slotter. Development of suitable broaching technique has enabled manufacturers to reduce the machine time on the anti-tank gun breech ring from 8 hours to 20 minutes.

Use of honing machines not only has reduced the time necessary for finishing the bores of cannon, it also has provided much better and more accurate surfaces. This greater accuracy now permits the use of broaches to cut rifling grooves in the barrel. The total saving in time as a result of these improvements enables us to make nine cannon barrels in the time formerly required for one. Many other similar instances could be cited, and it is expected that our present wide-spread munitions program will bring forth numerous additional improvements suggested by the experiences of commercial manufacturers.

Defense Production Now Hinges On Tool Engineering Efforts

BY O. W. WINTER
Factory Manager
Columbus McKinnon Chain Corp., Tonawanda, N. Y.

■ THE great problem today—and this is emphasized by a recent American Society of Tool Engineers' survey—is the shortage of skilled machinists, tool and die makers, tool designers and tool engineers. This shortage existed even before the bulk of $11,000,000,000 worth of defense business came along. Anything contributing to productivity of existing skilled groups is highly important. At the same time, additions to their ranks through extensive "upgrading" training by industry in co-operation with the technical schools is a patriotic necessity, increased use of semiskilled, freshly trained workers being mandatory during this crisis.

In the past five years, much attention has been devoted to attachments, tools and machines for increasing tool making efficiency. In other words, "transfer of skill" from man to machine, long a characteristic of production shop methods at last has penetrated to the toolroom. A wide variety of bench tools, attachments and fixtures which toolmakers used to make for themselves, can now be purchased out of stock, thus conserving valuable time.

Current demand for new machine tools is being reflected in growing popularity of a number of ingenious motor drive attachments for modernizing older belt-driven equipment. With these, a smart engineer can do a lot toward increasing the productivity of his old equipment when he finds deliveries on new machines to be prohibitively long.

Defense under present conditions involves a degree of mechanization three or four times greater than in 1914-18 so it is fortunate indeed that we are blessed with so many technological developments. Effective application of unskilled or semiskilled production labor will become infinitely simpler once enough of this modern equipment is made available through the efforts of tool engineers. In the meantime every possible effort must be made to provide the necessary technical personnel and skilled workmen required to get this equipment built and tooled for production at the earliest possible moment.

When Skilled Labor Is Scarce Build Skill into Machines

BY J. A. ELWOOD
Factory Manager, Pump Division
Sundstrand Machine Tool Co., Rockford, Ill.

■ MAJOR problems in our business is those presented by intensified production requirements brought on by the rearmament program. Of these problems, that of adequate manufacturing space we have solved by building larger quarters for manufacturing. Like everybody else these days we are up against the allied problem of deliveries on certain machine tool equipment. This we must have so that we, in turn, can produce our machines faster for the benefit of those engaged in the manufacture of airplane engine parts, shells, tanks, submarines, rifles, and the multitude of other vital defense materiel.

Another important problem is that of the shortage of skilled labor. This is having a definite influence in the trend of the design of machines, especially in regard to work locating and chucking devices. Machines must now be provided with easily controlled devices which will simplify the operator's duties and minimize idle time. Paralleling this simplification, is a growing tendency toward employment of automatic cycles in machine operation.

A good example is a new hydraulic mill recently furnished for milling locating notches on a crank shaft. This part is difficult to hold without distortion, because of its irregular shape. There are five separate movements within the fixture to position and clamp the part properly; a cross movement of the head to permit an easy loading and unloading of the fixture; and a feed movement of the table. All of these motions are accomplished hydraulically, and are controlled automatically from a centralized pushbutton station on the front of the machine.

No particular skill is necessary to operate this machine. Safety devices will not permit cross movement of the head or longitudinal movement of the table except in proper sequence—and not even then until the crank shaft is properly clamped in the fixture. Practically fool proof, machines of this type show the progress being made by machine tool manufacturers in their never-ending endeavors to reduce operator effort and simplify difficult machining operations. Oil-power variable-speed transmissions and torque converters, together with their controls, are being used on many machine tools to obtain selection of speeds, and reversal at predetermined points. This system acts faster than any operator can possibly think. Further development of hydraulics and their broadened application to the machine tool and other industrial fields is a very definite trend.

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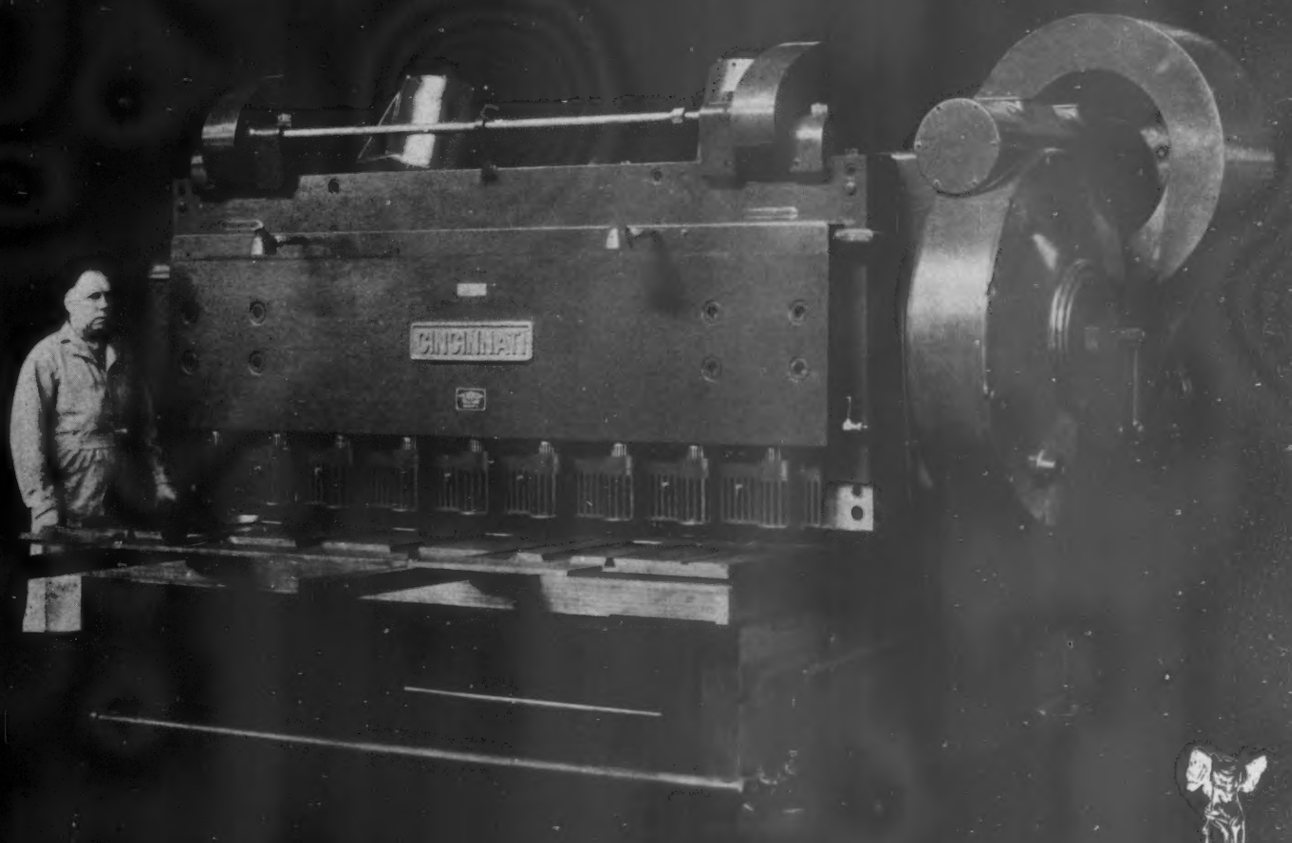


THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS · SHEARS · BRAKES

Don't Try to Make College Men Into Toolmakers; It Won't Work

BY CHARLES J. MARKS
Chief Tool Engineer
United Aircraft Corp., East Hartford, Conn.

■ THE major problems facing industry in the manufacture of airplane motors and planes for the defense program today is lack of skilled mechanics in the following branches: Jigs and fixtures; gage making; making dies for blanking, forming and drawing. The whole industry setup depends on this equipment—all the way through from the machine tool builders to makers of accessories which go to complete the airplane. This condition has been brought about in this country by lack of interest on the part of men in control of industries in apprenticeship training of toolmakers to replace "old timers" who have dropped out of the picture through retirement.

Since the emergency program was started there has been some activity in apprentice schooling. However, we are not covering this particular branch of the industry by training the proper class of young men. Applicants generally are required to have an advanced education, preferably college. I believe those requirements are wrong, for the reason that after a boy has spent 3 to 5 years in college, his ambition is beyond earning his living by the hard work involved in toolmaking.

The ideal apprentice toolmaker is a boy from a farm, fishing village or forest, who has been taught from boyhood to work his own way out of difficult problems mechanically. Education required to become a good toolmaker need not have extended beyond that in simple mathematics. Too many who have gone further than that have a tendency to look for a managership or vice presidency in an organization rather than to stick to the job of toolmaking.

America Will Surpass Europe In Application of Carbides

BY W. G. ROBBINS
President
Carboloy Co. Inc., Detroit

■ IF THE closing months of 1940 serve as an indicator for continuing trends in 1941, United States industry during this year will rapidly approach, if not surpass, Germany and Great Britain in the extent to which cemented carbides are used for metalworking. Although cemented carbides have been used in steadily increasing quantities during the past 10 years, the last half of 1940 showed a phenomenal increase in their use for cutting steel. Demand for these steel-cutting grades doubled and even quadrupled month by month. Inception of the defense program and continued reductions in carbide prices combined to stimulate demand for these tools which increase production per machine and per man-hour.

Fortunately the carbide industry had anticipated the possibility of being required to step up its own output. Seeing use of cemented carbides for armament production abroad already common and even mandatory, plants were built and equipped here in the United States to insure capacity capable of meeting all conceivable cemented carbide tool demands.

Development of lines of standard tools over the past year and their introduction to industry during the closing months of 1940, are further facilitating the use of cemented carbides. In addition to making lower prices possible through standardization and mass production, all this simplifies selection of tools and grades by users. A further development is the rapidly extending use of cemented carbides for sheet metal working as well as wire-drawing dies. The extreme hardness of these materials resists wear of dies, thereby maintaining tolerances over longer periods of time and giving greatly increased production quantities per die.

Cemented-carbide dies are also coming into extensive use for production of shells and various other metal products requiring accurate finishing on press equipment.

New Types of Precision Gages Minimize Inspection Time

BY W. D. CREIDER
Sales Manager, Machine Tool Division
Cimatool Co., Dayton, O.

■ WITH sudden awakening of the United States to its national peril came demands on industry which in any other country would have been impossible— because of the speed at which they had to be accomplished. To their lasting credit the machine tool, small tool and gage industries—in fact the entire metalworking industry—patriotically have shouldered their full responsibility. They have expanded facilities and increased production to meet this emergency.

Mass production depends primarily on the principle of the interchangeability of manufactured parts through adequate dimensional control, possible only by means of precision gaging equipment. It was inability to produce adequate inspection equipment in 1917 and 1918 that proved a serious handicap to our world war munitions program. Since then, many important improvements have been made in gages and in gaging practice which today gives us important advantages. A number of gages developed in recent months by Sheffield Gage Corp. have increased the speed of precision inspection from 5 to 20 times over what it was in 1918.

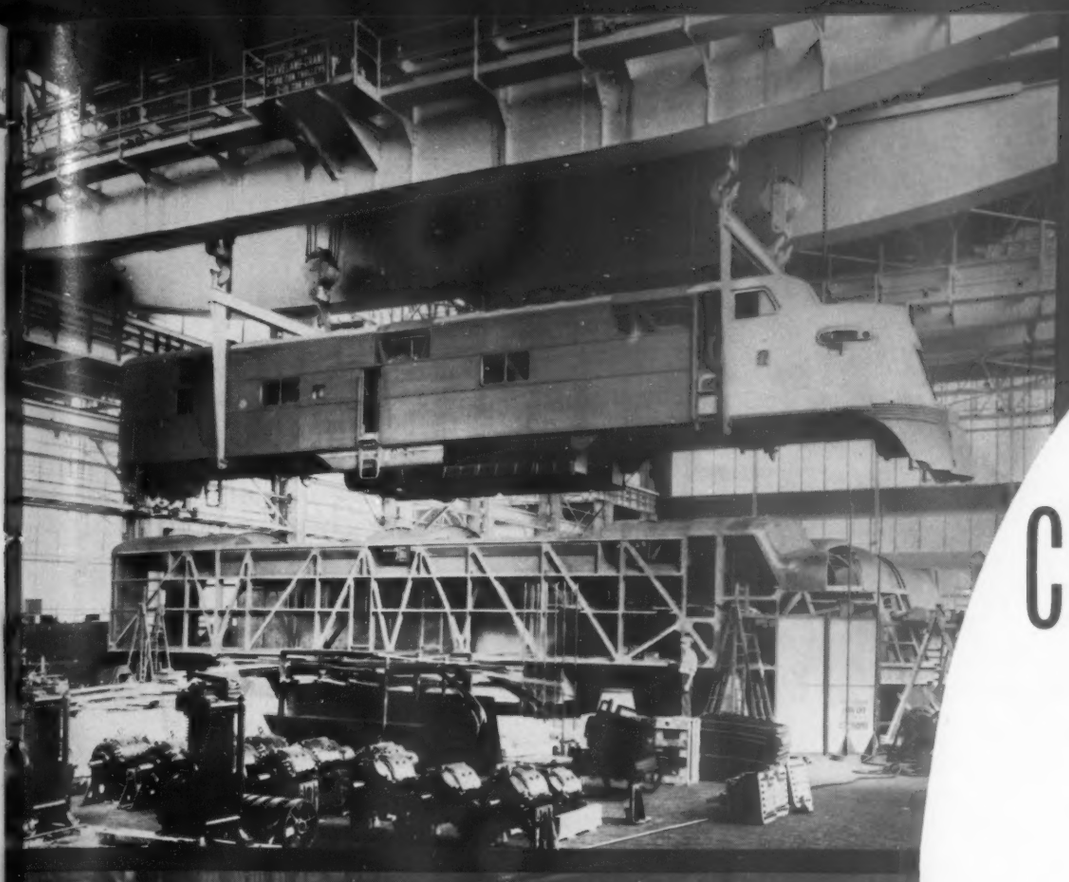
For example, an electric gage is now being used to check simultaneously as many as eleven separate internal and external dimensions, both on shells and on cartridge cases. It is adaptable to parts of practically any size. Another gage is a typical example of what has been done lately to speed up inspection of internal diameters. This gage, which utilizes compressed air as a medium, reduces gun bore inspection time to a mere fraction of that formerly required.

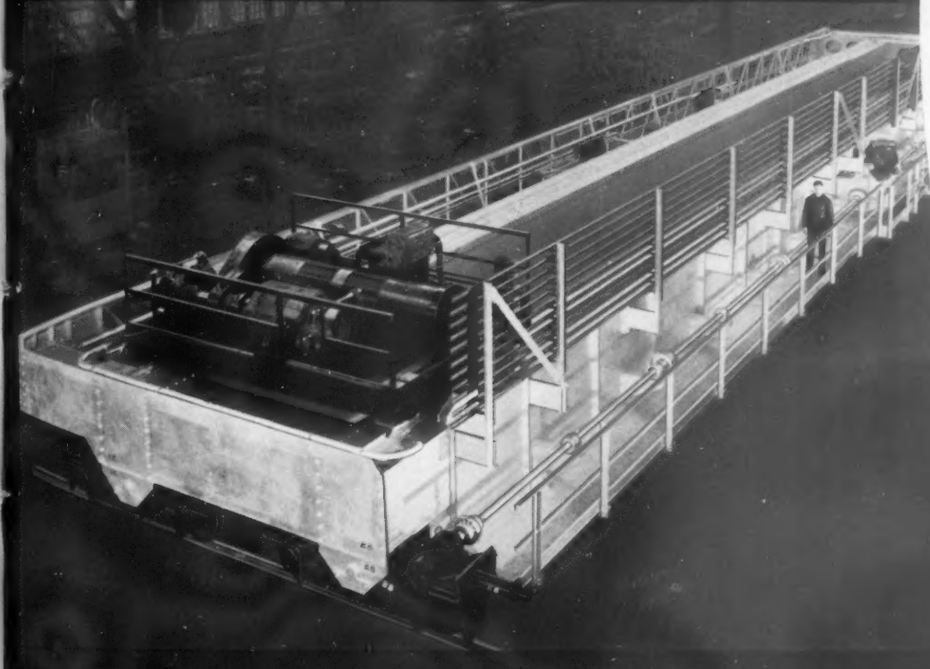
Sweeping Redesigns in Tooling Are Due to Cemented Carbides

BY GEORGE H. JOHNSON
President
Gisholt Machine Co., Madison, Wis.

■ OUTSTANDING development in the field of turning machinery during the year 1940 has been the very large increase in the use of the cemented carbides in cutting tools. This has been brought about partly by price reductions on these alloys and partly by necessity for increasing production on all machines to meet requirements of the defense program. This widely expanded use of carbides has required improved designs both of special and of standard tools to enable full use to be taken of the increased speeds and feeds obtainable.

Modern machine tools such as turret lathes have for





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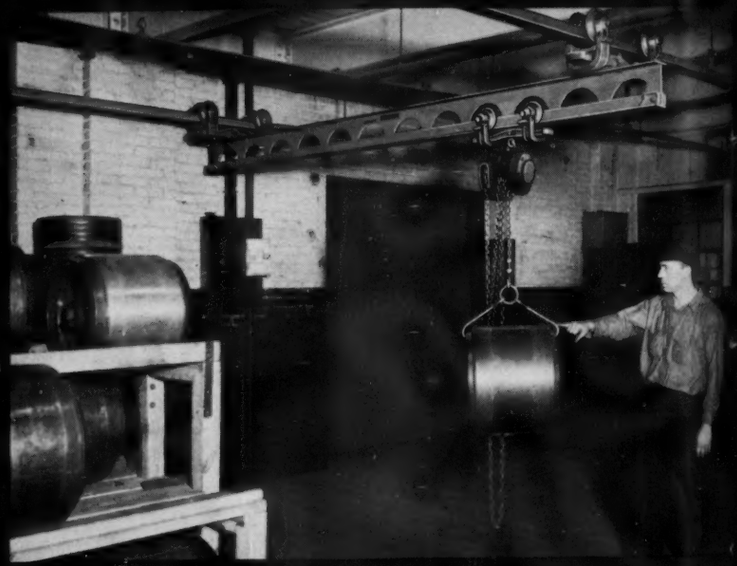

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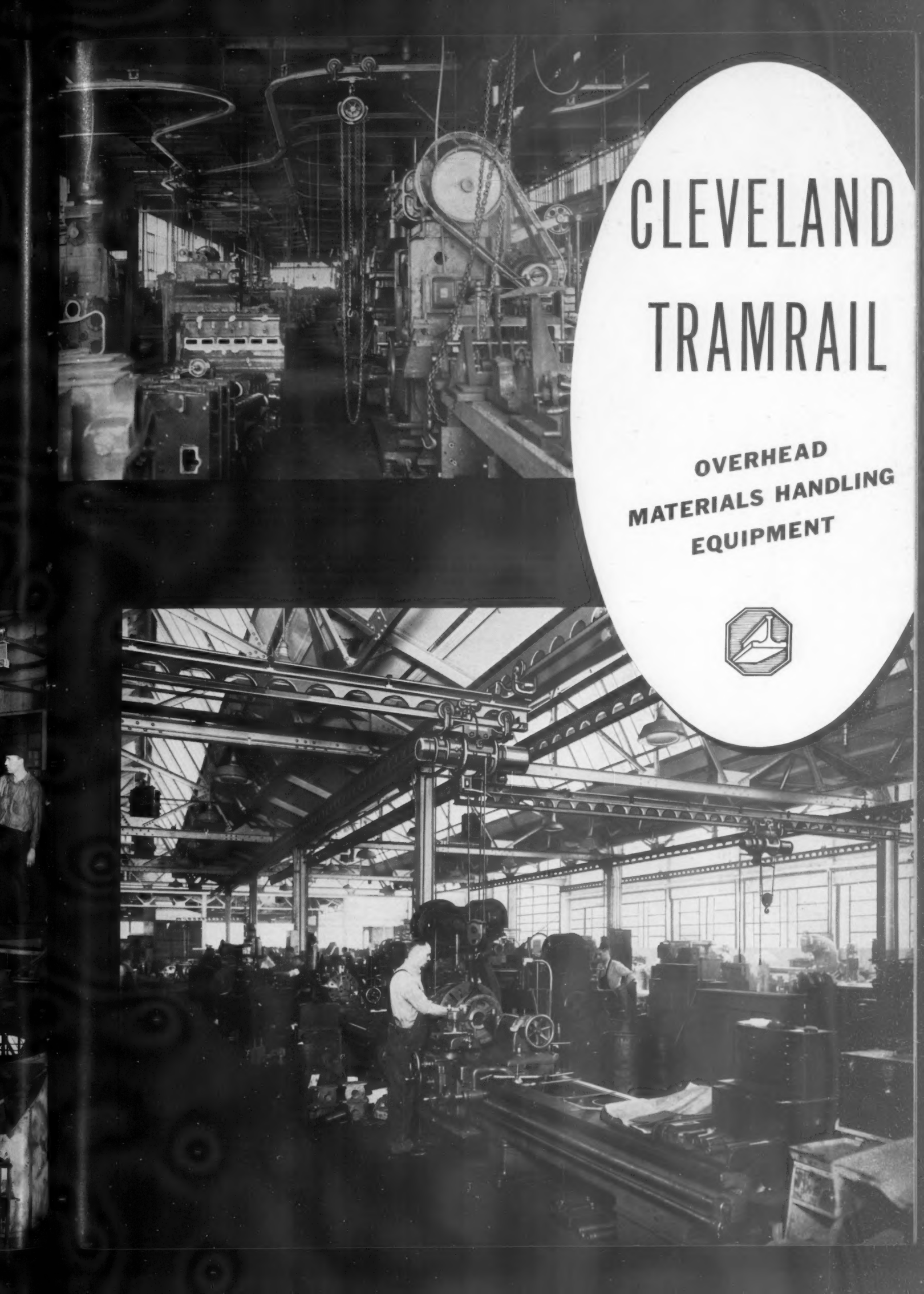

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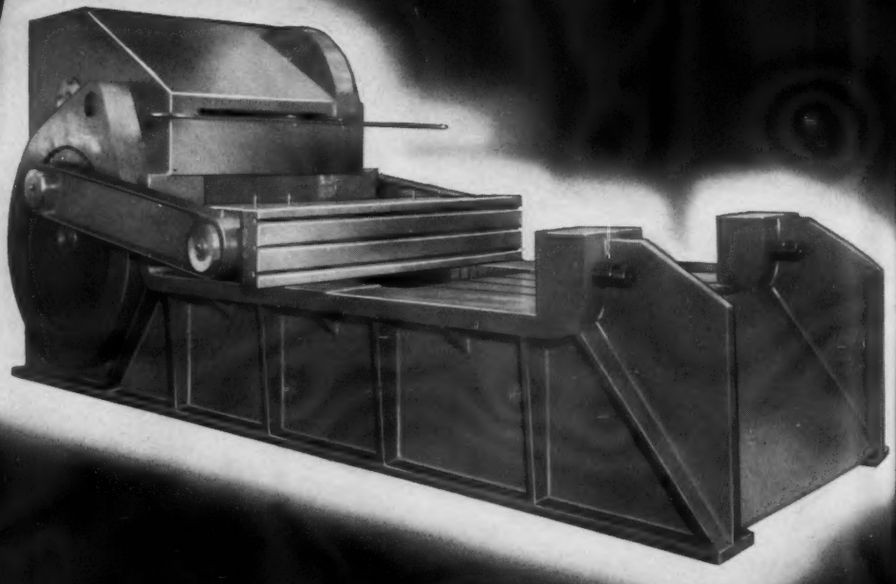

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some time been capable of taking care of the higher speeds and feeds required to take full advantage of carbide tools. However, increased and broadened applications of these alloys, particularly on small lot production, have necessitated basic improvements in tool design all the way along the line. For example, a few years ago it was considered relatively impossible to use carbide alloys for the machining of steel, whereas now it is possible to apply them in the machining of a large majority of steel parts with great success. Consequently, improved tools and tool holders for this important service have had to be developed recently by machine tool builders.

Every Machine Tool Should Now Be Working 24 Hours a Day

BY J. R. WEAVER
Director of Equipment, Inspection and Test
Westinghouse Elect. & Mfg. Co.,
East Pittsburgh

■ DEFENSE has saddled an extremely heavy load on industry—a load particularly difficult to handle because unfamiliar products are involved in most cases. This demands a lot of new thinking, as well as new facilities. In the meantime, normal production also has increased materially. The resulting demand for machine tools and related facilities is so great that doubts have been expressed as to the ability of the machine tool industry to meet the sudden heavy requirements.

The real bottleneck in this industry expansion program does not lie in delivery of machine tools but in the lack of operators for machine tools and the scarcity of skilled help in general. Therefore, it is highly desirable that industry and our educational institutions co-operate at once in quick training of machine operators and other help needed to man our machine shops. In normal industries, there are right now manufacturing facilities capable of meeting heavily increased demands. Machines should be manned 24 hours per day, 5 days per week on either three 8-hour shifts or four 6-hour shifts. Many existing machines are not yet being operated to any such extent as this. If these somehow could be made available to those who really need them, it would relieve the pressure upon the machine tool industry and would hasten delivery of essential defense materiel.

From the machine tool builders' standpoint, as well as from that of industry generally, it is highly desirable that existing facilities be employed to their fullest extent before adding new facilities. Undoubtedly, after this defense program is completed, the machine tool industry will put on the market even more efficient and more highly productive machines than are available today. Such developments will make it desirable to replace most of existing machines with those improved machines to meet most effectively the increased demands for lower prices and high quality goods. Industry will be in much better shape to do it then, if it does not indulge in overexpansion now.

Superduty Brick Now Can Be Made from Kentucky and Pennsylvania Clays

BY G. A. BOLE
Research Professor, Ceramic Engineering
Engineering Experiment Station
Ohio State University, Columbus, O.

■ ONE OF the finest things that has happened in the refractories industry in recent years has been the development of superduty brick. During the past year Dr. Ralston Russell has published a bulletin in which he gives certain data whereby he was able to produce in the laboratory a satisfactory superduty brick from Kentucky and Pennsylvania clays. His work indicates that the quality of the brick is dependent upon the proper selection of raw materials, their grain sizing to produce a low absorption, and the degree of the burn. The problem has been to decrease slag penetration, maintain or improve spalling resistance, and keep after-shrinkage low.

Improved test methods for evaluating the spall and after-shrinkage of fire brick are a result of a program of several years duration of the American Refractories institute fellowship at the Mellon institute. Furnace procedure has been worked out at the institute and standard furnaces are being installed at the larger producing plants.

The production of a superior grade of insulating brick is a continuous development. It is now recognized that a different pore structure is required in low-temperature than in high-temperature insulation. Only a few companies are taking advantage of this fact. Research, however, is paving the way for its accomplishment.

And Now at the Eleventh Hour We Must Rush to Train Men!

BY NORMAN D. MacLEOD
President and General Manager
Abrasive Machine Tool Co.
East Providence, R. I.

■ WE ARE engaged in making toolroom equipment largely, and for that reason the real production problems faced in large production shops do not reach us. Most of our own internal production problems are being solved in rather orthodox manner, and we are doing nothing which could be considered as particularly unique or novel in that respect.

The great problem facing industry today is that of training men to take over the many jobs now waiting for them. I still cannot understand why our tax money and borrowed money was not spent during several years past for vocational training instead of for "displacement of leaves."

Swing Is to Mass Production In Aircraft Industry

BY JOHN J. LEE
Superintendent, Production Planning
Curtiss Aeroplane Division
Curtiss-Wright Corp., Buffalo, N. Y.

■ IN ATTEMPTING to predict developments in aircraft production—say for the next five years—one cannot overlook substantial strides made by this industry in the last five. Prior to this period, production quantities were small, parts were produced mostly by hand or with inexpensive simple tooling, and with little thought to interchangeability or manufacturing costs. Production costs were high and deliveries slow.

Although mass production records of the automotive industry have not yet been threatened, aircraft production methods lately have undergone marked improvement. Many special machines and ingenious tools have been developed to meet production requirements. Hand work is being minimized by use of blanking and forming dies, router cutting of large blanks, stack drilling and gang perforating. In machining of forgings and castings, jigs and fixtures are providing for multiple-spindle drilling, and gang milling where production warrants. In all this, production planning plays an active part.

It is obvious that by having larger contract orders, costs

can be reduced by purchasing raw and finished materials in larger quantities. Also, production runs can be increased and can be continued without interruptions. To reduce costs still further and to conserve materials which are becoming more and more difficult to obtain, studies are being made toward reduction of scrap and elimination of waste. Although the keynote of the industry today is "speed," it is essential that this speed be obtained without sacrificing quality—performance of the finished product and interchangeability of various units being of utmost importance. American production methods and high standards of quality are established virtues which are receiving praise from many foreign countries.

24 Men Load-Unload New Press; Six Die Slides Synchronized with Automatic Press

BY VANCE R. PARKER
E. W. Bliss Co., Brooklyn, N. Y.

■ MANY new and interesting developments in press equipments have recently made their appearance, largely under stimulus of the defense program. A few of them include increased accessibility of working parts in the newer "streamlined" designs, the use of straight-side automatic presses for small arm cases, the supplanting of the rack-and-pinion presses and larger knuckle-joint heading presses by fast-acting hydraulic presses in the production of the larger cartridge cases, the new hydraulic 6-slide press for the airplane industry and the use of high-production automatic presses for small parts.

Most press equipment being built today is connected with rearmament or the production of munitions. For small-arm cartridge cases such as the 30 and 50-caliber sizes, larger and faster machines are being used. Multiple dies in straight-side pressses have increased production rates many times over those of the last war when open back gap frame presses were so extensively employed.

In making larger cartridge cases for 3-inch, 105-millimeter and 90-millimeter shells, perhaps the most marked change has been the supplanting of the old rack-and-pinion redraw presses by new high-speed hydraulic presses. Not only do these new hydraulic machines give greater production and better work, but their flexibility as to stroke and die space will allow them to be used for general purpose work when the crisis is over. In heading larger cases, those requiring machines over 1500 tons, hydraulics are used extensively due to ease of pressure control and pressure generation.

For aircraft work, the hydraulic press has been developed to produce many varied stampings simultaneously, acting against a rubber pad. A further step in this direction is a new machine with six die slides that are loaded and moved in under the press slide as each die slide is ready, independent of the position of the die slide. This machine is so arranged that 24 men can load and unload work, whereas in the older design only 12 were able to load and unload. This does away with idle press time while waiting for loaded die slides. Full automatic control is featured whereby the die slide moves in, the main slide comes down and goes up and the die slide moves out, all in automatic sequence. Independent pressure control is available for each die slide.

Amazing speeds characterize the use of high-production automatic presses designed for high-speed output and increased die life. These presses are being used in the present emergency with progressive dies for machine gun links, rifle clips, fuse parts, primer cups and a host of other small parts which are required in vast quantities.

Better Materials and Methods Mean Stronger, Quieter Gears

BY W. P. SCHMITTER
Chief Engineer
Falk Corp., Milwaukee

■ MAJOR developments of the past year have been directed toward attaining higher standards of gear accuracy in order to achieve quieter operation and increased load carrying ability. They may be summarized as follows:

Resort to free-cutting alloy steel blanks pentrated to 300 or 400 brinell for heavily loaded small industrial gears, thus avoiding fire-distortion. Necessary capacity is obtained by virtue of improved contact, lower self-induced stresses and better tooth forms. Some success is being reported with nickel-cobalt hobs for cutting hard steels.

Extension of rotary shaving to helical and herringbone gears up to 25 inches in diameter. Principal application is in connection with gearmotors, speed reducers and diesel engine timing gears. Practice is to multithread hob leaving 0.002 or 0.003-inch for finish shaving.

Trend on large rolling mill and similar type gearing is toward high impact-resistant alloys, air or liquid quenched before cutting. Flame hardening has not proved satisfactory in this field. Development of precision multithread S-hobs for staggered tooth, narrow gap herringbones, has been sponsored by Falk Corp. for such applications.

Percentage of gears being lapped has increased with advent of improved technique and equipment. Some use is being made of three dummy laps (standard, all addendum, and all dedendum) where reduction of spacing error is sought in addition to surface refinement.

Automatic welders with variable-speed table drives are now being applied successfully in making gear frames. Best available records indicate lowest costs of combination cast-welded housings when cast steel does not exceed 10 per cent of rolled steel. Manufacturers supplying main propulsion marine drives needed for the defense program are faced with a major problem in tooling up for quantity production of precision units which run up into thousands of horsepower and which must operate at pitch-line speeds exceeding 3 miles per minute.

Emergency Inspires Simplicity In New Machine Tool Designs

BY R. S. ELBERTY
Electrical Engineer
Landis Tool Co., Waynesboro, Pa.

■ THE typical European manufacturer bought American machine tools for flexibility. He went into mass production with his fingers crossed, buying machines that could readily be changed over to manufacture a number of products or parts. On the other hand, the American manufacturer now gains productive capacity through the use of special-purpose machine tools. We note an increasing trend toward semi-automatic and automatic high-production machines tooled for specific jobs. Machine flexibility becomes a secondary consideration. There has been a long-time trend toward high production machinery but the present emergency has intensified this demand.

Machine rigidity, drives, hydraulic and electric controls, and special modifications are major considerations to the machine designer. Ingenious mechanisms for sizing, work handling and automatic control will be developed as a result of our need for increased production. The engineering burden imposed by this demand hits home hard to

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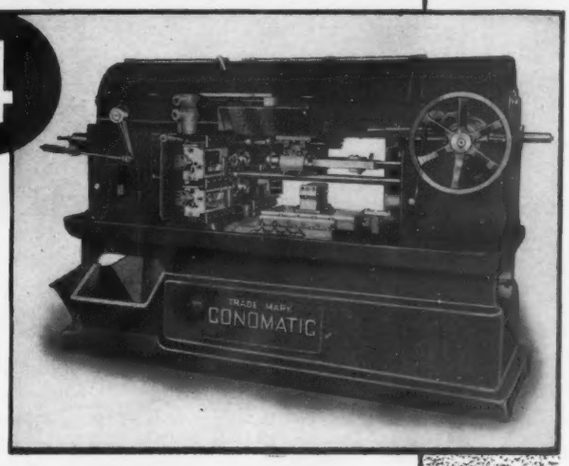
4



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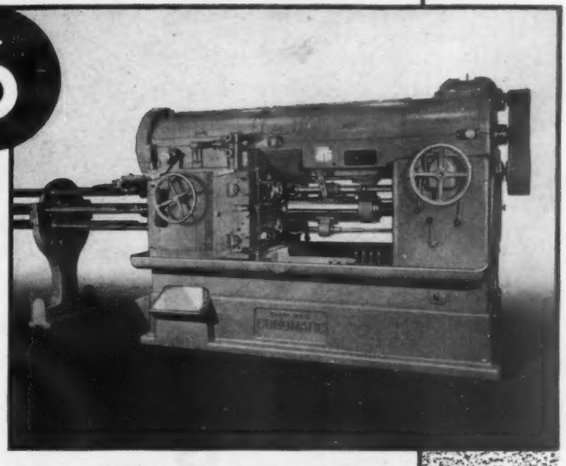

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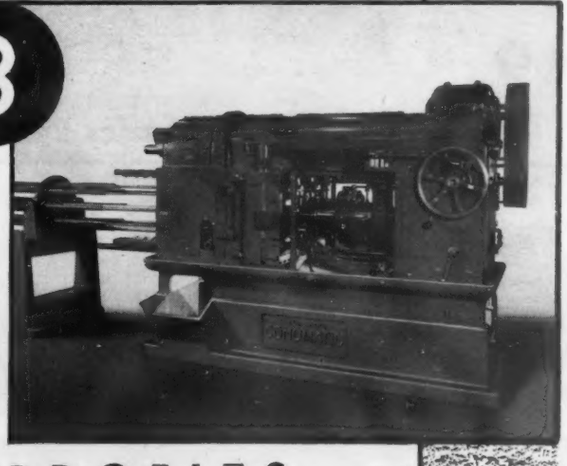

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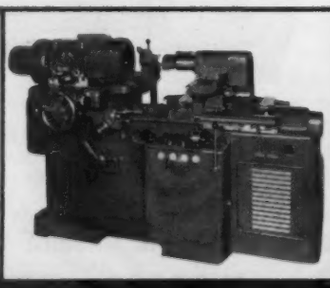
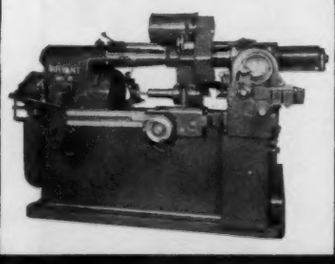
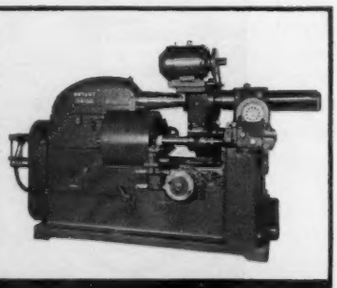
			

BRYANT CHUCKING GRINDER CO., Springfield, Vt.

the machine tool industry. The end result will probably be a simplification of engineering design, to hold to established standards with minimum of frills. Under present conditions we now seek the quickest solution to a problem and we do not have much time for embellishments. On the strength of all this, I predict a return to conservatism and simplicity in machine tool design, but there will continue to be rapid advances in the development of high-production machinery of the automatic and semi-automatic types.

Man-Hour Output Is Increased Without Fatigue to Operator

BY CHARLES J. STILWELL
President
Warner & Swasey Co., Cleveland

■ OUTSTANDING in metalworking is the rapid increase in use of cemented tungsten carbides. Already many plants are developing departments devoted entirely to introduction, proper application and care of such tools. Whereas cemented carbides for a number of years had been used for turning cast iron and some nonferrous metals, they are now—because of present urgencies—being adapted very rapidly to the turning both of mild and alloy steels.

Heretofore cemented carbides have been used extensively in large production shops but now, however, we find that they are being welcomed by the small manufacturer who is under just as much necessity as anyone else to increase his production. This represents a significant development. Bearing in mind that cemented carbide tools, used as they are at much higher speeds and under heavier feeding pressures, demand more rigid support below the cutting edge, it becomes obvious that this trend has necessitated intelligent and intensive redesign of cutter holding devices, noticeable particularly in increased size of their shanks.

A second recent trend in machine tool design has been the rapid introduction and refinement of power operation. Power is being applied more and more wherever any considerable physical effort previously has had to be exerted in the operation of machine tools. Both of these development trends have sensed primarily in our own experience in turret lathes. However, it is understood that similar trends are current in other branches of our industry. These things are in the direction of attaining greater production per man-hour with no increase in the physical effort required of the operator of the machine tool.

Don't Defeat the Purpose of Good Cutting Fluids By Failing to Provide Proper Facilities For Delivery, Cleaning and Cooling

BY W. C. LOCKWOOD
Cutting Oil Engineer
The Texas Co., New York

■ MAJOR oil companies, as well as several specialty concerns, are devoting considerable time and money to developing improved cutting fluids to meet the constantly increasing demand placed upon them for products which will permit higher cutting speed and feed with deeper cuts. Not only are these demands being met successfully, but research work now under way, will make it possible to meet any reasonable future requirements.

Should cutting fluid be applied improperly to cutting tools, however, this costly research will have been completely wasted. In view of the importance of this phase, machine tools already in use and those now on order should be so equipped as to permit free circulation of the cutting fluid in sufficient volume (not pressure) to cover adequately all of the numerous tools in action, thereby giving the necessary cooling and lubrication for greatest output.

With the defense program under way, it is most important that consideration be given reservoirs for machine tool cutting fluid. Since many machines will operate almost continuously, capacities of their reservoirs should be such as to allow cooling of the cutting fluid before its recirculation. And another thing, these machine tools should be constructed to allow easy removal of chips or grinding dirt. This factor seems to have been overlooked even in some recent designs. Several manufacturing plants have installed special tanks to act as auxiliary cutting fluid reservoirs. Where cutting fluid is subjected to especially high temperatures during the machining operations, these auxiliary tanks often are equipped with cooling coils through which cold water is circulated to cool the cutting fluid.

I repeat, a cutting fluid will not give the best results if it is not properly applied.

While Doing Utmost for Defense, Give Some Thought to Future

BY FREDERICK S. BLACKALL JR.
President and Treasurer
Taft-Peirce Mfg. Co., Woonsocket, R. I.

■ ONE of the significant corollaries of the defense program is the extent to which gages, jigs and fixtures, and machine tools are recognized as being, in very truth, in the "front line trenches" of the defense system. This is an eloquent commentary on the changing character of modern warfare. Happily, those who are charged with the responsibility for getting our defense production under way have been quick to sense the primary importance of these fundamental tools of size control and production. That gages and machine tools should be rated at once by the Priorities committee as the sine qua non of the defense program—that phase of the program, indeed, which must be given first attention—may have a not inconsiderable influence on the future. Too often engineers give too much attention to the product and, alas, too little and too belated thought to the tools and machines with which the product must be made.

Considerable advance in design and performance of machine tools should grow out of the present era. Tax laws and relative prosperity of the machine tool industry will engender increased research and product development. But a more cogent force will be the stark necessity which will face machine tool builders a few years hence of creating new demands with new products, this in a machine tool market which inevitably will be glutted with machines of existing types. No student of international commerce can fail to be concerned over what the future holds for the metal cutting industries of this country, as to probable dilution or outright loss of their export markets. During the past five years, England and Germany—England especially—have been perfecting their machine tool plants and have created all manner of defense plants which must find products to make when the war is over. America will lose, to a large and permanent extent, its export market for machine tools when peace treaties eventually are signed. These are sobering thoughts but it is well for business men to bear them in mind and to prepare for the conditions to which they point. We must be preparing concurrently for other days when a battle on a new front will ensue—a battle for commercial existence in a sadly changed world.

Output Is Boosted 225 Per Cent Under Eleven-Point Program

BY W. E. WHIPP
President
Monarch Machine Tool Co., Sidney, O.

■ WE ARE proud to report a current increase in production of 225 per cent over 1939, and we have every reason to expect a further step-up in 1941 over 1940. This has been and is being achieved by the following measures and methods: Substantial increase in plant area; installation of additional machine tool equipment and facilities; increased use of cemented carbide tools and milling cutters which are worked at their top speeds and feeds for maximum production rather than cautiously for uneconomically long tool life; improved jigs and fixtures for simplification of work holding and machining; continuous operation of the plant machines, during 20 hours per day, totaling 100 hours per week; operation 24 hours per day of certain machines that might otherwise constitute "bottlenecks" in production flow; contract machining of some of our parts by outside companies whose experience and machine tool equipment is adequate to meet our requirements; constant analysis and breakdown of assembly operations so that new men may contribute quickly to increased production; double shifts on assembly work to keep pace with the increased number of machined parts flowing to the assembly departments; growth by division—higher skilled members of our organization being spread out in fan-shape to impart job knowledge to those of lesser skills; training courses that impart quickly to our new men additional "inside" information related to the machine tool trade—information beyond that which they ordinarily would gain through mere shop experience.

This is a very brief summary of our continuing and vigorous efforts as machine tool builders in the direction of earliest possible attainment of the defense goal.

Farsighted Machine Tool Makers Don't Let Development Lapse

BY E. P. BLANCHARD
Sales Manager
Bullard Co., Bridgeport, Conn.

■ IT IS natural that one of the outstanding developments in the machine tool field lately has been the introduction of simplified special-purpose machinery intended for munitions only. Of these, shell lathes are perhaps the best known, but in all lines where items for munitions have gone into mass production promptly there have been wide developments in special machinery.

In this connection it is interesting to observe that certain manufacturers of standard machines have tended to move in this same direction. Because standard universal items are not required for specific mass production work, and also to get machine tools that will serve specific purposes, many of these builders have simplified their lines. This, in turn, has helped to "streamline" their production (I mean in "flow" of work, not design shapes) and they have been able to increase their volume of production appreciably as a result.

In the past—during times like this—the machine tool business always has been so deeply concerned with getting out production that little or no attention has been paid to design changes and improvements. This condition does not hold true at the present time, however. In addition to the engineering work required for simplification and development of special types, as noted above, definite action is being taken on the part of several machine tool builders in the way of allotting certain engineering capacity for development now of improved devices—if not entirely new models—for the future.

It is very well conceded that when the present bulge in business is passed, it is then going to require marked advances in the ability of machine tools in order to "obsolete" present designs which now are being pushed on the market in such large volume. In other words, when orders again become scarce, those few that are placed are destined to go to those companies who then have new models to offer—new models that will show marked advantages over those which we think of just now as being "the last word" in machine tool design.

Simple, Single-Purpose Tools Have Place in Defense Program

BY C. N. KIRKPATRICK
Vice President
Landis Machine Co., Waynesboro, Pa.

■ LANDIS Machine Co., in common with other machine tool builders, is striving to meet the requirements of the national defense program. The size and scope of this program dictates a trend which, while not entirely new, will grow by necessity. This trend is toward use of single-purpose machines instead of multiple-purpose tools.

In many plants where high production has been required, single purpose tools long have been used advantageously. Their low initial cost and probabilty of much better delivery are two advantages to be considered—the latter especially being of prime importance now. Then too, unskilled labor in many cases is entirely suitable for operation of simple single-purpose machines, whereas the more complicated general-purpose tools require the attention of a good mechanic and in many cases of a trained operator plus a setup man. Considering low initial investment involved, the simple tooling required and the small amount of experience required for successful operation in the case of single-purpose machines, the demands of the defense program are, in our opinion, destined to be met to a large degree by employing these simple, sturdy machines.

To that end Landis Machine Co., in addition to its regular line of thread cutting machines, has now developed a new type shell tapper for tapping nose ends of shells. It is designed to be employed in a line made up of other single-purpose machines, and results prove that this shell tapper solves what otherwise might be a rather difficult production problem.

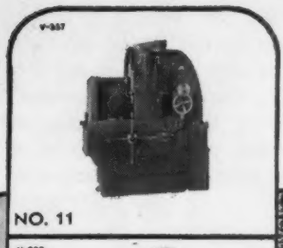
Continued development of cutting tools is inevitable. Metallurgically, cutting tools already have reached a high state of perfection compared to those of a few years ago. However, we may expect still more strides in that direction in the not far distant future. We ourselves are giving particular attention to developments in thread-cutting tools which not only will further enhance their work quality and production efficiency but which also will still further reduce tool costs.

Better Control of Coatings for Prefinished Metals Greatly Increases Service Performance

BY F. P. ROMANOFF
Apollo Metal Works
Chicago

■ UTILIZATION of prefinished sheet and strip metal has kept pace with the increased use of electrocoated finishes.

BLANCHARD



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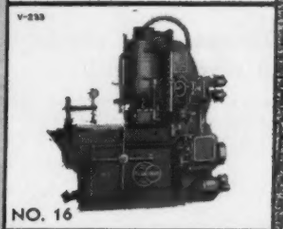

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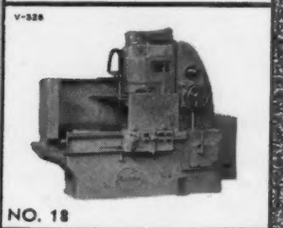

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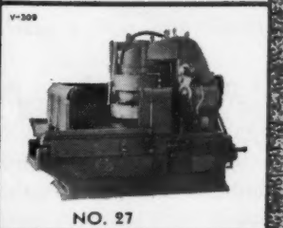

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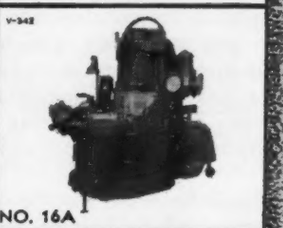

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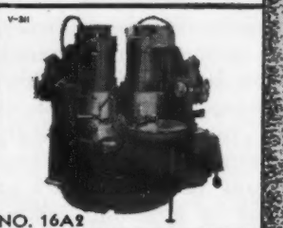

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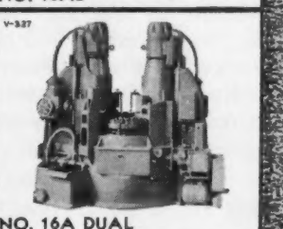

NO. 16A DUAL

BLANCHARD WHEELS

Blanchard Surface Grinders are cutting costs and improving quality on both production and tool work

BLANCHARD

THEY are massive, powerful machines with ample weight of metal where it is needed for rigidity. Their controls are convenient and easy to operate. They generate a flat surface by the rotary motions of work and wheel — this makes wheel truing unnecessary and saves cost and time, especially when grinding from the rough.

Since Blanchard Grinders practically eliminate set-up time, the output per machine is high, even with an average operator.

A new development is the production of very fine finishes by Blanchard Grinding. If your work requires flat surfaces with a finish of a few microinches (by profilometer) the No. 11 or No. 18 Blanchard Surface Grinder with fine grit wheel, made by Blanchard, will produce them for you.

To keep Blanchard Grinders at maximum efficiency, it pays to use wheels manufactured by Blanchard.

A General Catalog covering the complete line of Blanchard products, or catalogs on any specific Blanchard product, will be sent on request.

BLANCHARD

THE BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASSACHUSETTS, U. S. A.

Rigid adherence to improved treatments has resulted in the development of commercial deposits with physical properties closely corresponding to those of the base metal. Methods of controlling these properties of both nickel and chromium deposits and practical testing of them enables commercial production of coatings with better service performance. A few refinements will permit more effective use where fabrication is so controlled that the increase in surface area is not greater than that for which the prefinished coating is designed.

Data will soon be available covering the physical properties of nickel deposits with stress strain curves showing variations in deposits, as well as in steel of similar temper, and photomicrographs of elongated ductile and nonductile deposits.

Management Must Appreciate Men As Well as Mechanisms

BY E. S. SAWTELLE
Vice President and General Manager
Tool Steel Gear & Pinion Co., Cincinnati, O.

■ ALONG with all the technological advancements in equipment, machinery, jigs, gages, etc., the most important factor in industry today is an understanding of the human element. Our employes year after year have better fundamental educations. Their enlarged reading and study, their more intimate knowledge of the little tricks in their own particular job fit them to be real, co-operative partners in industry *if* such partnership is sought and cultivated intelligently.

Does management always realize the latent talent in its organization? Does it look at the individual employe as a potential co-operator, or as merely a clock number? Since we all work for pay, there can be no fundamentally sound relation between employer and employes that is not predicated upon fairness in pay. One of the greatest evils in the organized labor movement is the levelling of all workers to a common standard of pay regardless of their skill, their experience or their attitude toward their job.

Real progress can be inspired only by rewarding financially the man who is able to stick his head and shoulders up above others in his wage class, and by anticipating promotions rather than giving them grudgingly when demanded. Astonishingly good results are obtained with well developed individual and group incentive plans. In addition, every industry should try to put into operation some form of overall incentive applicable to every employe and geared to the profits of the company. Our experience indicates that such incentive should be given monthly, should preferably fluctuate reasonably with the individual monthly showings and should be diligently "sold" to employes by word of mouth, by bulletins, publications and every other method available.

Profit-sharing, of course, is always well received when business is good. Its crucial test comes when profits diminish or disappear. This is not merely a test of the good will and sportsmanship of employes. Rather it is a measure upon the ability and resourcefulness of management over months or years in interpreting the profit-sharing system to each individual employe and preparing each mind for its fluctuation, its peaks, its valleys or its temporary disappearance.

Tooling Engineers in Canada Cope With Wartime Realities

BY ARNOLD THOMPSON
Chief Tooling Engineer
Canadian Acme Screw & Gear Ltd., Toronto, Canada

■ TRENDS in machine tool design are toward rigidity, flexibility and simplicity and toward semi-automatic operation with press-button control. Flexibility and simplicity adapt such machines for a greater variety of work over which to amortize their first cost. They also should be designed to promote use of female labor. Use of female labor is essential for the defense program and will eventually, I believe, become more generally practiced in times of peace. Home labor-saving devices, made possible by mass production methods, have released women from many duties in the home, thus making more of them now available for factory work.

The immediate shortage of machinists and tool makers further emphasizes the need of simplicity which will allow use of unskilled labor. Simplicity and flexibility also help considerably in maintenance and in future adaptation to other products. In the meantime, educational authorities and industry must co-operate actively in the vocational training of young men. Improved cemented-carbide tools emphasize the necessity for greater rigidity and higher speeds. In Canada, munitions manufacturing is tending to revert to the practice of the last war, automatics being used primarily as stock removers and finishing being done on simple turret lathes, multicut lathes, drilling and tapping machines.

Rigidity, flexibility and simplicity must also be incorporated into toolholders, fixtures and holding devices—all must be designed for maximum production efficiency. Accuracy tests and inspection methods on armament and munitions work, likewise are being revised. This is in the direction of simpler technique adapted for use by women on inspection work. Box jigs are practically out. Complicated multi-drilling, reaming and tapping heads are being used sparingly. In many cases multi-index milling fixtures are being superseded by broaching, while there is a tendency for precision boring to take the place of reaming and internal grinding. Superfinishing and honing are due to become much more generally used. Progressive die work and improved diecasting machines are two other factors which are helping to reduce production costs and to conserve labor.

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Raw Materials

■ RAW MATERIALS producers in general kept pace with record-breaking demands by the steelmakers during the past year. Only marked deficiency was in coke supplies. With by-product ovens at capacity most of the year antiquated beehive ovens were pressed into service. By early November 5127 ovens at Connellsville were operating; 300 more may be rehabilitated. During the first ten months 2,031,700 tons of beehive coke was produced, or nearly three times as much as during the corresponding 1939 period.

Vessel shipments of Lake Superior ore were 63,712,982 gross tons, or 41½ per cent above the previous year, and third largest on record. Record shipments were in 1929, with 65,195,595 tons; in 1916, 64,734,198 tons was shipped.

Ore stocks at lower lake furnaces and docks Dec. 1, 1940, were estimated at 41,000,000 tons, or about the same as the 40,732,096 tons a year before. Assuming the war continues at present intensity, and ore consumption continues at 6,000,000 tons monthly, stocks on May 1, 1941, will be only 11,000,000 tons as against 18,106,151 tons on May 1, 1940.

Iron ore consumption in 1940 is estimated at 62,500,000 tons, compared with 44,361,289 tons in 1939. Estimated all-rail shipments for 1940 were 550,000 tons.

On Sept. 15 the entire ore fleet of 296 vessels was engaged for the first time last year. Severest storm on the Great Lakes in 27 years occurred in November when two lake freighters foundered off the east coast of Lake Michigan. The storm's effect decreased by 2,000,000 tons the amount of ore expected to be moved.

Domestic scrap consumption in 1940 broke all previous records at an estimated 41,000,000 gross tons, against 38,006,272 tons in 1937, previous record.

Scrap exports in the first ten months of 1940 were 2,678,759 gross tons as against 3,098,369 tons for the corresponding 1939 period. The decline was due in large measure to the embargo against shipments to Japan, which applied to No. 1 heavy melting steel only in the late summer, but became effective on all grades by mid-October. Moreover in 1939, until the outbreak of the war Sept. 1, the European continent had been buying large quantities through the scrap cartel, which included Germany and, in fact, all scrap-consuming countries except Russia. In 1940 Britain was almost the sole European buyer, though Italy purchased until she entered the war.

Total coke production for the year, based on ten months' known figures, is estimated at 56,000,000 net tons, highest since 1929 when 59,883,000 tons was turned out. Up to Nov. 1, by-product production was 44,219,634 tons against 33,627,000 tons for the same period of 1939. Beehive output was 2,031,700 tons against only 752,800 tons in the same 1939 period.

Lake shipments of limestone in 1940 are estimated at 15,500,000 tons, greatest since 1929.

Bituminous coal loadings from Lake Erie ports by Nov. 30 were 47,483,821 net tons, having exceeded any full year for which records were kept.

Ore, Scrap, Coke, Limestone Statistics

(Unit: 1000 tons)

	Lake Superior Ore Consumed	Lake Superior Ore Shipped by vessel	Domestic scrap consumption	Total coke production	Lake shipments limestone
1940	62,500*	63,713	41,000	56,000*	15,500*
1939	44,361	45,073	32,434	44,425	12,208
1938	25,703	19,263	21,528	32,496	8,240
1937	53,996	62,598	38,006	52,375	14,429
1936	44,639	44,822	36,358	46,275	12,080
1935	30,789	28,362	26,415	35,141	9,082
1934	22,113	22,249	18,800	31,821	7,392
1933	18,115	21,623	17,400	27,589	6,664
1932	10,283	3,567	10,000	21,788	3,928
1931	24,114	23,467	18,300	33,728	7,208
1930	45,192	46,582	26,600	48,302	12,432
1929	63,645	65,196	37,600	59,883	16,269

Iron ore and scrap, gross tons; coke and limestone, net tons.
*Estimated.

Steelworks Expansion

Pouring ladle of open hearth steel into ingot molds at plant of the Wisconsin Steel Co., South Chicago, Ill.

By JOHN D. KNOX
Steel Plant Editor

■ BELLS on time clocks are heard above the tramp of many thousands of feet these days as steel workers pass in and out of iron and steel plants at the change of turns. Factory wheels are humming and smoke stacks are emitting lazy fumes — maintenance crews keep themselves in readiness to make a breakdown in any department pale into insignificance. Tonnage is the word that echoes from plant enclosures—no matter how small the plants may be.

Over in the by-product coke plant clouds of steam shoot out the top of the quench house at regular intervals as car after car of red-hot coke is cooled down to handling temperature. Only on rare occasions have ovens been pushed for tonnage as they are today. Every available oven is in operation and so tight has the coke situation become that one large steelmaker is operating old-type Belgian ovens on the beehive principle. Another is importing coke from England.

Turboblowers at blast furnaces are delivering their regular amount of cold blast. Skip tracks over which raw materials are taken from the stockhouse to the top of the furnace have a high polish. Trestle gangs are spotting hopper cars of ore, limestone and coke over bins night and day at a rate unmatched since 1929. Furnace crews show little concern when a tuyere burns. "Keep the iron going to the steelworks mixer" is an order that is self-understood today. Every blast furnace capable of being blown is delivering hot metal by way of the iron notch. Mention slow-blowing to a blast furnaceman and he'll tell you he hasn't heard of such practice for many months and doesn't expect to hear of it for many months to come.

Walk the full length of the charging floor in any open-hearth shop and scarcely will you find an idle furnace. True, some may be found down for a new roof or lining but an open-hearth furnace that is not on the charging line today is a rarity. The little old charging machine is inserting many a box of scrap through the charging doors of furnaces and dumping it on the hearth. Cranes over on the pouring side of the open-hearth shop are swinging many a ladle of steel from beneath the tapping spout to the pouring station across the aisle. Every melt shop in the country today is a busy beehive.

Pull open the door of any rolling mill in our land and see how mill crews are keeping steel in the rolls. The wonder is how they handle the product delivered on the cooling beds at such a fast rate. The shriek of a whistle brings a heated ingot into the bite of blooming mill rolls and after a few crunches the steel is dispatched on its way to the finishing line to reappear shortly on the bed of a truck-trailer or railroad car securely anchored for transit to the customer.

How long will the steel industry be obliged to operate at the present rate? Who can say? A survey of the international horizon lends little promise of a slowdown even for many months to come. As long as the shape of bombers is shadowed on the earth, as long as torpedoes leap from the submarine's tubes, as long as tanks clank over the cobblestones of some of the principal capitals of the world, just so long will the iron and steel industry in this country continue to make the sparks fly from old Vulcan's anvil.

Too many loaded guns are cocked in mountainous countries and desert places. Too many lies, placarded propaganda, are making their rounds. And so as

An Announcement and an Invitation

ARTHUR G. McKEE & COMPANY announce the opening about January 15th, of headquarters in the new McKee Building at 2300 Chester Avenue, Cleveland, Ohio.

This modern, fireproof, 34,000-square-foot building is completely air-conditioned for winter and summer. Designed to provide ideal working conditions, it is spacious and unusually well lighted.

The completion of the McKee Building marks another forward step in this company's thirty-four years of service to the Iron and Steel and Oil Refining Industries.

The modern facilities and conditions provided in our new headquarters place us in a position to serve you more efficiently than ever before.

We take this opportunity to extend to you a cordial invitation to visit us in our new home whenever you are in Cleveland.

Arthur G. McKee & Company

Engineers and Contractors

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long as the world is mined for destruction, battle fleets must slide down the ways. Tomorrow's army must be forged. This all requires steel. How well the industry understands the situation can be recognized from the accompanying table and programs of new construction. The tendency, however, is to proceed with caution lest idle equipment stares the industry in the face when there is no longer need for emergency facilities. Nevertheless, an analysis of programs completed last year and building schedules soon to be placed underway compare favorably with and in some cases surpass those of the past decade.

At a cost of about $18,000,000, Bethlehem Steel Co. has authorized a program of new construction that will add about 850,000 of steel ingots, 800,000 tons of by-product coke and 700,000 tons of pig iron to its present annual capacities.

Last November the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., announced a program of expansion that will increase its steelmaking facilities about 400,000 tons or 20 per cent.

Weirton Steel Co. has its engineering department working on drawings for the construction of a new 1000-ton blast furnace and 64 by-product coke ovens for erection at Weirton, W. Va. The Great Lakes Steel Co. will replace one of its Detroit stacks and Hanna Furnace Corp. one at Buffalo.

Sustained operation of blast furnaces in 1940 aggravated a condition that long has been prevalent but about which little has been done, namely, the shortage of by-product cokemaking facilities. The shortage of coke has induced many beehive oven operators in the Connellsville district to start their ovens after a long idleness. Many batteries covered with grass and thistles for years are again being made to look respectable and soon will have coke on its way to blast furnaces.

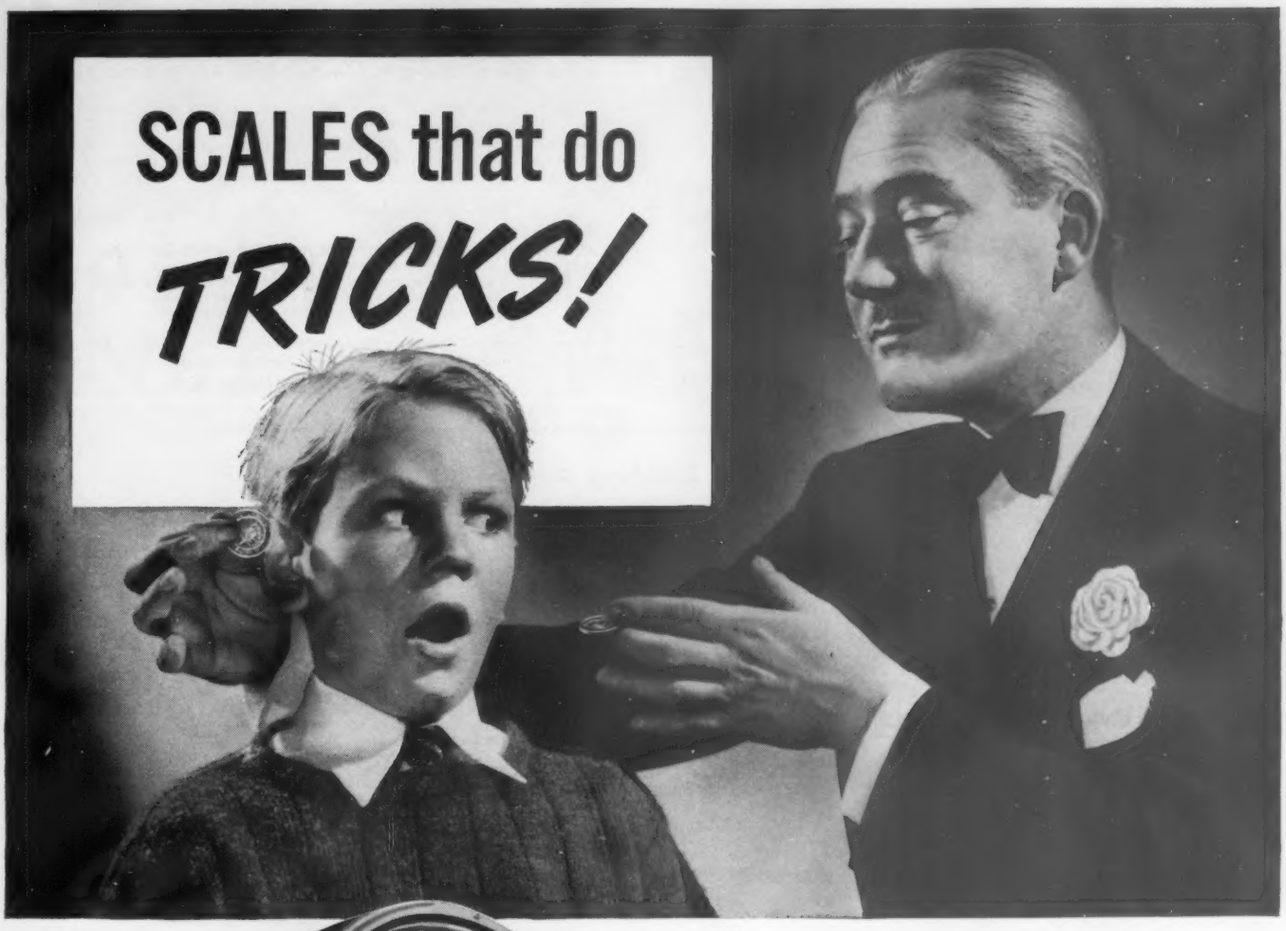
Meanwhile, 699 by-product ovens are on order or are being laid down, 142 of these being a replacement job. Not since 1926 has any annual program of new construction of cokemaking facilities exceeded this number of ovens. If blast furnace operation continues at its present rate, additional by-product ovens will have to be laid down as a national defense measure. One company has even gone so far as to spray oil on the oven mix with the hope that an increase in the yield might be secured.

Perhaps the most pronounced phase of iron and steel works construction programs for 1941 is the number of electric furnace additions. Six concerns are installing eight furnaces which will add about 725,000 tons to the national output. Last year 10 electric furnaces were laid down with an annual output of 900,000 tons, the Republic Steel Corp. adding four 50-ton units at its Canton, O., plant making it the largest electric steel producer in this country.

Strip manufacturers who for many years have been heavy contributors to the list of new mills included in annual rehabilitation programs are said to have their plants in the best physical condition in many years. Records are being broken daily, weekly, and monthly; only the shortage of steel prevents present

Tapping a heat of steel from an electric furnace at the South Works of the Carnegie-Illinois Steel Corp., Chicago. Many arc-type electric furnaces are being installed this year for the production of alloy steels

SCALES that do TRICKS!



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records being shattered. The present tendency is to remodel early built hot strip mills to roll wide stock as well as to increase the delivery speed of 4-high tandem cold strip mills in excess of 2000 feet a minute, especially mills working on tinning stock.

New construction completed in 1940, or in the state of building at the opening of the new year, follows:

REPUBLIC STEEL CORP.

Completed or Underway

Youngstown District: Skelp coiling equipment on 19-inch mill, flame control on bessemer vessels, Lin-de-Surfacer on 19-inch mill, additional soaking pit capacity, skelp pickling equipment for coils.

Warren District: New cold mills and auxiliary equipment, silicon strip annealing furnaces, improvements to No. 3 hot strip mill, improvements in open-hearth pouring aisle to handle larger heats, coil welding equipment, continuous pickling line, cutting line for coils, buildings for storage and shipping hot strip.

Central District: Alloy steel finishing and galvanneal equipment, carriage type and roller hearth heat treating furnaces, additional soaking pit capacity.

Buffalo District: Improvements to open-hearth ladle cranes, increased open-hearth capacity, equipment to handle shell steel billets.

Chicago District: Electrification of Moline mill, building for wire storage and shipping.

Cleveland District: Enlargement of open-hearth furnaces, soaking pit and enlargement of present pits, improvements to ore docks and storage facilities at blast furnaces, equipment for production corronized sheets, building at 98-inch hot strip mill, additional annealing capacity, improvemets to plate processing lines.

Birmingham District: Concentration plant at Spaulding mine for beneficiation of ore, opened Spaulding ore mine, installed

(*Please turn to Page* 371)

Equipment Completed, Building and Authorized in 1939

Open-Hearth Furnaces Building

	Number of furnaces	Daily capacity, tons	Annual capacity, tons
Bethlehem Steel Co., Sparrows Point, Md.	6	200	680,000
International Harvester Co., South Chicago, Ill.	2	100	140,000
Midvale Co., Nicetown, Philadelphia	2	90	130,000
Total	10		950,000

Electric Furnaces Completed

Company	Number	Capacity, tons
Copperweld Steel Co., Warren, O.	2	25
Ford Motor Co., Dearborn, Mich.	1	4
Ford Motor Co., Dearborn, Mich.	2	10
Republic Steel Corp., Canton, O.	4	50
Universal Cyclops Steel Corp., Bridgeville, Pa.	1	10
Total	10	

Electric Furnaces Building

Company	Number	Capacity, tons
Byers Co., A. M., Ambridge, Pa.	1	15
Carnegie-Illinois Steel Corp., S. Chicago, Ill.	1	30
Carnegie-Illinois Steel Corp., S. Chicago, Ill.	1	60
Copperweld Steel Co., Warren, O.	1	25
Copperweld Steel Co., Warren, O.	1	10
Midvale Co., Nicetown, Philadelphia	1	15
Northwestern Steel & Wire Co., Sterling, Ill.	1	50
Republic Steel Corp., Canton, O.	1	50
Sharon Steel Corp., Lowellville, O.	1	20
Timken Roller Bearing Co., Canton, O.	1	60
Total	10	

Blast Furnaces Authorized

Company	Number of furnaces	Daily capacity, tons	Annual capacity, tons
Bethlehem Steel Co.	2	1000	690,000
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.	1	850	294,000
Weirton Steel Co., Weirton, W. Va.	1	1000	345,000
Total	4		1,329,000

Blast Furnaces Remodeled

Company	Name or number
American Rolling Mill Co., Hamilton, O.	No. 2
Carnegie-Illinois Steel Co., Braddock, Pa.	"G"
Ford Motor Co., Dearborn, Mich.	Henry
Republic Steel Corp., Youngstown, O.	No. 2
Republic Steel Corp., Cleveland	No. 1
Republic Steel Corp., Birmingham, Ala.	No. 1
Total	6

Blast Furnaces Remodeling

Company	Identification
American Steel & Wire Co., Donora, Pa.	No. 1
Bethlehem Steel Co., Bethlehem, Pa.	"A"
Carnegie-Illinois Steel Corp., Rankin, Pa.	No. 3
Great Lakes Steel Corp., Detroit	"B"
Hanna Furnace Corp., Buffalo	No. 4
National Tube Co., Lorain, O.	No. 3
Otis Steel Co., Cleveland	No. 2
Republic Steel Corp., Youngstown, O.	No. 4
Youngstown Sheet & Tube Co., Campbell, O.	"C"
Total	9

By-Product Coke Ovens Building

Company	Number of ovens	Type of ovens*	Est. annual coking cap., tons
Alabama By-Products Corp., Tarrant, Ala.	25	K-B	121,500
American Rolling Mill Co., Hamilton, O.	25	K-B	159,100
Bethlehem Steel Co., Bethlehem, Pa.	51	K-B	226,700
Bethlehem Steel Co., Lackawanna, N. Y.	76	W	384,000
Bethlehem Steel Co.	102¶	..	448,800¶
Carnegie-Illinois Steel Corp., Gary, Ind.	142†	K-B	855,000
Citizens Gas & Coke Utility, Indianapolis	41	K-B	352,800
Connecticut Coke Co., New Haven, Conn.	9	K-B	53,800
du Pont de Nemours & Co., Inc., E. I., Morgantown, W. Va.	37	W	181,300
Semet-Solvay Co., Ironton, O.	76	W	372,400
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.	51	K-B	298,900
Weirton Steel Co., Weirton, W. Va.	64‡	....	412,800¶
Total	699		3,867,100

†Replacement; ‡Contemplated; *K-B, Koppers-Becker; W, Wilputte; ¶Estimated.

Rolling Mills Completed

Company	No. mills	Type mills
Acme Steel Co., Riverdale, Ill.	1*	22" 4-high cold strip
American Steel & Wire Co., New Haven, Conn.	1	18" 2-high temper
American Steel & Wire Co., Worcester, Mass.	2‡	8" 4-high cold strip
Bethlehem Steel Co., Sparrows Point, Md.	2	cont. buttweld
Bopp Steel Co., Dearborn, Mich.	1‡	24" 4-high cold strip
Carnegie-Illinois Steel Corp., Irvin, Pa.	1*	4-high cold strip
Cold Metal Process Co., Youngstown, O.	..	18" 4-high cold strip
Columbia Steel Co., Pittsburg, Calif.	1†	3-high breakdown
Columbia Steel Co., Pittsburg, Calif.	1†	2-high hot sheet
Continental Steel Corp., Kokomo, Ind.	1	3-high breakdown
Elliott Bros., New Castle, Pa.	1‡	18" 4-high cold strip
Follansbee Bros. Co., Follansbee, W. Va.	2‡	34" 4-high cold strip
Follansbee Bros. Co., Follansbee, W. Va.	1	42" 4-high skin pass
McLouth Steel Corp., Detroit	1	12" skin pass
National Supply Co., Etna, Pa.	1	cont. buttweld
Republic Steel Corp., Youngstown, O.	1	cont. buttweld
Rustless Iron & Steel Co., Baltimore	1	28" billet
Rustless Iron & Steel Co., Baltimore	1	12" merchant
Rustless Iron & Steel Co., Baltimore	1	9" merchant
Rustless Iron & Steel Co., Baltimore	1	cold mill
Signode Steel Strapping Co., Chicago	1	reversing
Superior Steel Corp., Carnegie, Pa.	1	30" 4-high cold strip
Thomas Steel Co., Warren, O.	1	8" 4-high cold strip
Ward's Sons Co., E. T., South Boston, Mass.	1	6" 2-high skin pass
Wheeling Steel Corp., Benwood, W. Va.	1	cont. buttweld
Wheeling Steel Corp., Steubenville, O.	1	4-high skin pass
Wheeling Steel Corp., Steubenville, O.	1	4-high cold strip
Wheeling Steel Corp., Yorkville, O.	1	4-high skin pass
Youngstown Sheet & Tube Co., Campbell, O.	1	cont. buttweld
Youngstown Sheet & Tube Co., Ind. Har., Ind.	1	cont. buttweld
Youngstown Sheet & Tube Co., Ind. Har., Ind.	1	2-high skin pass
Total	32	

*Tandem; ‡Reversing; †Replacement;

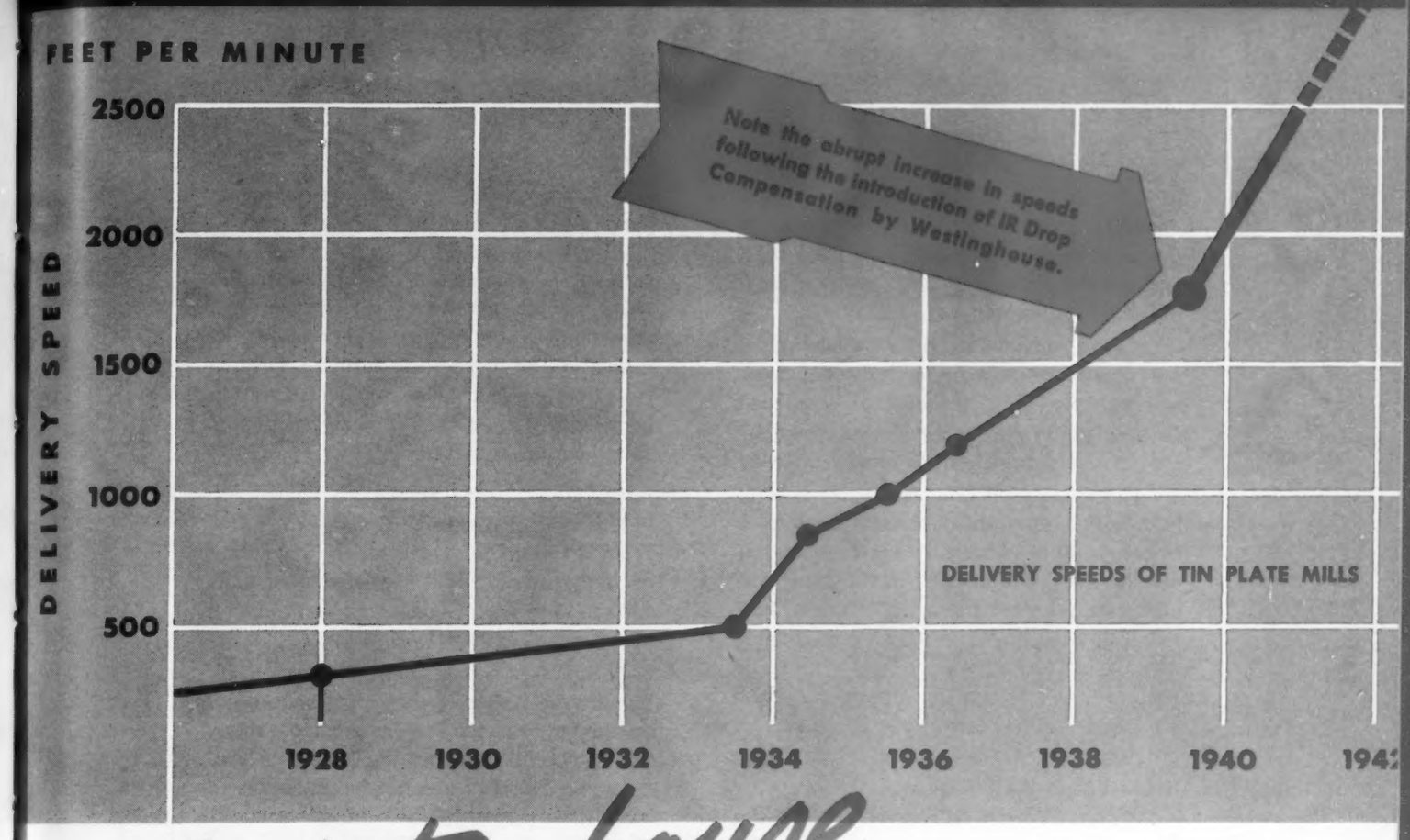
Rolling Mills Building

Company	No. mills	Type mills
Allegheny Ludlum Steel Corp., Brackenridge, Pa.	1	42" cold strip
American Rolling Mill Co., Ashland, Ky.	1*	68" 4-high hot strip
American Rolling Mill Co., Middletown, O.	1	48" 4-high cold strip
Granite City Steel Co., Granite City, Ill.	1*	90" 4-high hot strip
Republic Steel Corp., Cleveland	1	54" 4-high cold strip
Republic Steel Corp., Monroe, Mich.	1	4-high skin pass
Republic Steel Corp., Warren, O.	1	temper pass
Republic Steel Corp., Warren, O.	1†§	22" 4-high cold strip
Sharon Steel Corp., Sharon, Pa.	1	4-high cold strip
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.	1¶	140" plate
Weirton Steel Co., Weirton, W. Va.	6*	66" 4-high hot strip
Total	15	

*Single stand; §Replacement; †Tandem; ¶Authorized.

IR DROP COMPENSATION

FOR COLD MILLS...



A *Westinghouse* DEVELOPMENT

From rolling speeds of 1750 feet per minute to 2500 plus—that's the increase in delivery rate of cold rolled tin plate since 1939 when Westinghouse first introduced IR Drop Compensation. And Westinghouse IR Drop Compensation has made possible similar spectacular increases in the delivery speeds of sheet mills, temper pass mills and processing lines.

This Westinghouse development maintains uniform speed relationship between motors driving the various mill stands—not only at the high rolling speeds, but also during the retarding, threading and accelerating periods. It insures the operator of immediate and accurate mill response regardless of relative loads on individual motors. Fast threading and rapid acceleration and retardation are accomplished. It materially reduces strip breakage and the amount of off-gauge product. J-94412

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PA.

Westinghouse

TIME-SAVER FOR AMERICAN INDUSTRY

The Challenge of 1941 to Industry!

■ REFLECTED in the printed word and illustration of this first issue of STEEL in the new year is an American iron, steel and metalworking industry that is strong, resourceful and prepared.

Imagine, if you can, the emotions of an industrialist of Germany or Italy if he were looking over your shoulder as you read these pages. Would he not be impressed by the unlimited power of American industry which they indicate?

Editorial text and advertisements give evidence of the existence in this country of abundant supplies of most of the important materials required for a high standard of living in peacetime and for an impregnable defense in time of war. They reflect the presence of thousands of plants with equipment and machines unsurpassed in efficiency for every operation from mine to finished product.

Between the lines of type and behind the illustrations one can sense the throbbing of an industry which can call upon a tremendous supply of the world's best industrial manpower; which can command finances for adequate maintenance, frequent rehabilitation and liberal expansion of plant and equipment; and which can draw upon the world's largest pool of executive talent for the efficient management of its properties.

* * *

All of these factors of strength and many more would be clearly apparent to an industrialist of the axis nations could he grasp the significance of the industrial scene behind these pages. It would confirm his previous high regard for the high quality of American industrial enterprise. It would intensify his envy of our potential resources.

However, the knowledge of American industrial strength falls short of dismaying the collective axis mind for one simple reason. Leaders in the German and Italian alliance are complacent in the belief that our admitted industrial strength cannot and will not be marshalled effectively for defense or for assistance to democracies abroad. They are convinced that the weaknesses of the democratic form of government will prevent American industry from contributing more than a small fraction of its potential strength.

* * *

The 1941 challenge to the United States is to disprove this idea of the impotence of free states. It is a challenge that calls for an unprecedented degree of unity among all elements in American society.

To industry the challenge is particularly significant. We are going into the present emergency with the knowledge that in many once powerful countries the leaders of business and industry are not being entrusted with the responsibilities of government. They have lost the confidence of the people.

That should not happen here. Industry can see that it does not happen if its management will co-operate enthusiastically and intelligently in the defense program.

The appointment late in the year of the office for production management—a super-defense board with real authority—will go a long way toward clarifying industry's role in defense. It will make it easier for manufacturers to co-operate effectively.

We enter the new year with one clearly defined objective—total defense. It will be a banner year for industry if during the next 12 months its contributions to preparedness are so outstanding as to win the approbation of the public.

E. L. Shaner

The *BUSINESS TREND*

Industrial Production May Reach New Peak in 1941

■ OUTSTANDING in business developments for 1940 was the fact that industrial production, stimulated by defense expenditures, attained a new all-time peak. Barring unpredictable developments abroad, industrial activity should move upward to a still higher level during 1941.

In the closing weeks of last year, STEEL'S index of activity in the iron, steel and metalworking industries climbed to a new peak of 132.6. The highest level recorded in 1929 was 125.3, while the high point in the spurt of 1937 was 123.9. For 1940 the indicated average of STEEL'S index was 112.5. This compares with an average of 96.2 in the previous year and 104.1 in 1937. The depression low was 50.3 in 1932, while in 1929 the index averaged 109.5.

Each of the four weekly and 14 monthly business factors charted on the following pages recorded gratifying gains in 1940 over 1939 levels. A number of the business indicators climbed to new peaks in the closing months of the year.

The pattern of business activity during the past year closely followed 1939, in that through the first half of the year a moderate downward tendency was in process, followed by a rapid and vigorous upturn during the closing months. In the period from December, 1939 to August, 1940, STEEL'S monthly index average declined 17.8 points to 101.1. However, from August through December last year it rose to moderately above the 130 level.

During the latter part of 1940 new all-time records were established in steel ingot production, electric power consumption, machine tool output and aircraft assemblies. Railroad and agricultural as well as heavy electrical equipment manufacturers and electrical appliance concerns stepped up operations considerably during the closing months of last year. Revenue freight traffic and automobile production also turned sharply upward.

In all branches of the steel and metalworking industries large order backlogs have been accumulated, sufficient in most instances to sustain a high rate of operations at least through the first quarter of this year.

On a tonnage basis steelmaking operations reached a new monthly peak of 6,461,898 net tons during October. Daily average production in November was at an even higher rate, but the shorter month slightly reduced the total output.

Operations in the machine tool industry, measured in terms of payroll hours, advanced to 96.8 per cent of capacity during October, which is particularly significant in view of the fact that the industry's capacity had been increased 54.9 per cent from September, 1939 to November, 1940. Total production last year exceeded $400,000,000 and is steadily increasing. Certain types of machine tools are in great demand, out of all proportion to the normal needs of American industry. In some instances deliveries are extended into 1942. From the best estimates available the total new equipment installations in the industry since the start of the defense program approximate at least $30,000,000 and employment by members of the National Machine Tool Builders' association is now over 80,-

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000 men. On the basis of what the industry accomplished in 1940 and in light of the steady increase in production and further expansion planned or contemplated, the association anticipates output for 1941 will reach $600,000,000.

All important classifications of building construction are likely to record steady improvement throughout the first half of 1941, from which point a moderate tapering off is probable unless a greater intensification of armament effort with further large appropriations for construction should occur.

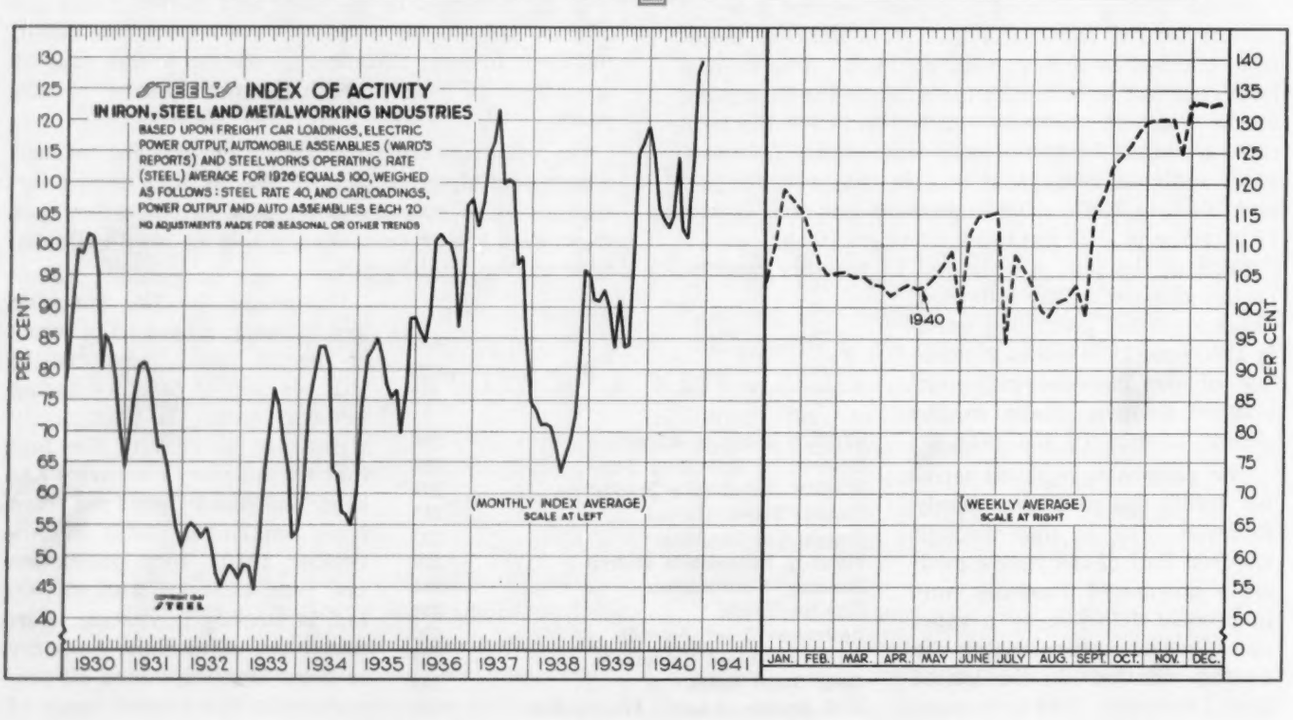
Aeronautical equipment manufacturers have spent $83,356,580 on plant expansion for national defense, and awarded contracts for an additional $232,188,472 worth of facilities which will be in operation by next June, according to the Aeronautical Chamber of Commerce of America. On Nov. 1 last the industry had an order backlog of $2,831,665,159, against $675,432,475 on Dec. 31, 1939. Deliveries in 1940 approximated $625,000,000, compared with $225,000,000 the previous year.

While industrialists wisely have kept prices relatively stable, the danger of war boom psychology is still present. Most manufacturers are determined to keep costs down, hold prices, wages, and all the other elements in the economic system in balanced relationship.

It is evident that one of the largest forward buying movements in recent years was underway during the latter part of 1940. Many non-defense industries were concerned lest their sources of supply be restricted due to the large government orders. Now that forward commitments have been made, and increased requirements provided for, most consumers are expected to follow the policy of maintaining inventories at present levels. This is reflected in the moderate tapering off in new orders reported in recent weeks.

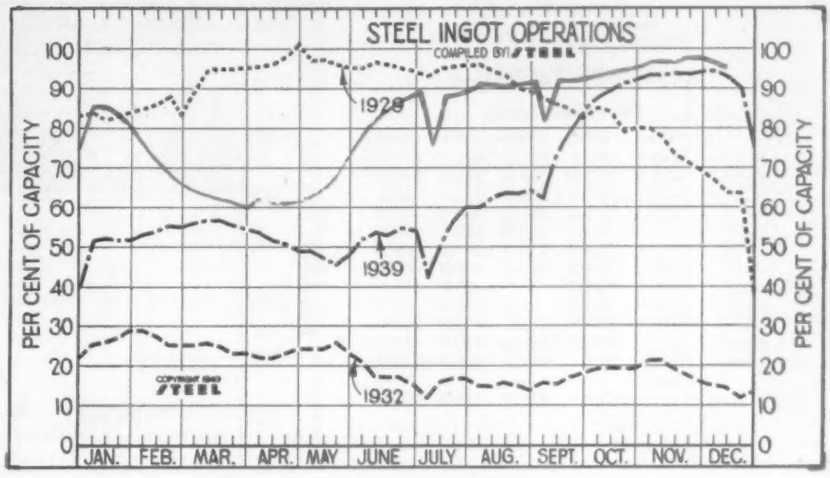
Despite the sharp upturn in buying during the closing months of last year, inventories generally have risen only moderately. The Federal Reserve board states that manufacturers have been using practically all the goods obtained, and consequently their inventories have not shown the large increase that might be expected. Nor have distributors accumulated excessive stocks.

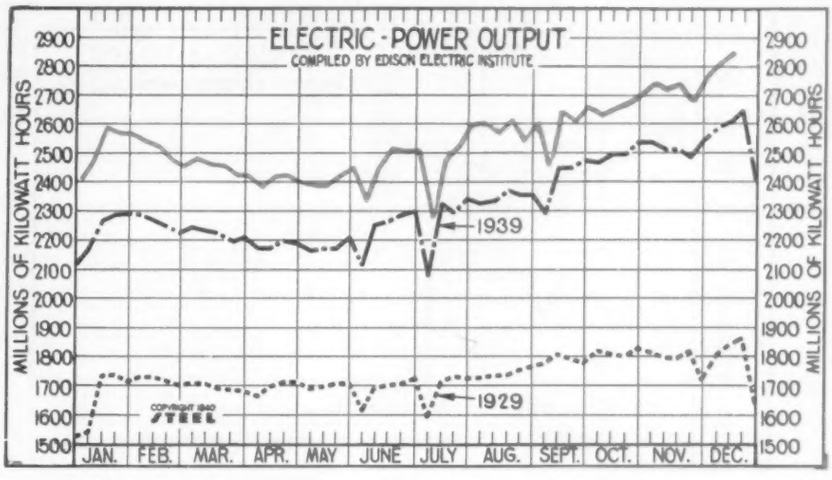
Industrialists are well aware of the present armament emergency and are carrying out their defense efforts in the same light as though we were actually at war. They realize that preparedness must take first place and that sooner or later other activities will be subordinated to the defense program, possibly to the extent of curtailing the production of consumer goods.

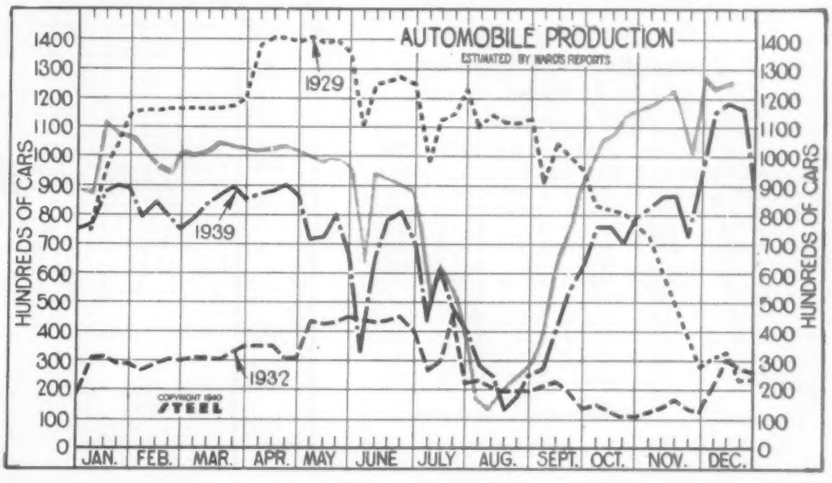

STEEL INDEX OF ACTIVITY
IN IRON, STEEL AND METALWORKING INDUSTRIES
BASED UPON FREIGHT CAR LOADINGS, ELECTRIC POWER OUTPUT, AUTOMOBILE ASSEMBLIES (WARD'S REPORTS) AND STEELWORKS OPERATING RATE (STEEL) AVERAGE FOR 1926 EQUALS 100, WEIGHED AS FOLLOWS: STEEL RATE 40, AND CARLOADINGS, POWER OUTPUT AND AUTO ASSEMBLIES EACH 20
NO ADJUSTMENTS MADE FOR SEASONAL OR OTHER TRENDS
PER CENT
(MONTHLY INDEX AVERAGE) SCALE AT LEFT
(WEEKLY AVERAGE) SCALE AT RIGHT
1940
1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

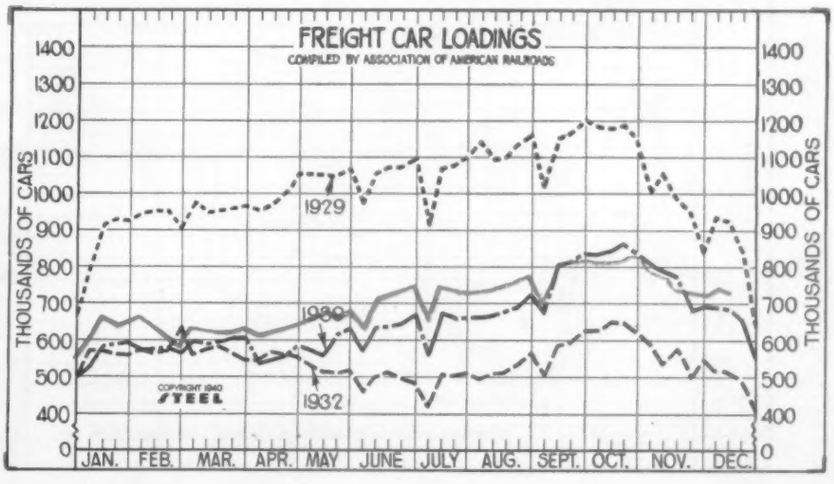
Week Ended	1940	1939	Mo. Data	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
Sept. 28.....	122.8	107.9	Jan.	114.7	91.1	73.3	102.9	85.9	74.2	58.8	48.6	54.6	69.1	87.6
Oct. 5.....	124.4	112.5	Feb.	105.8	90.8	71.1	106.8	84.3	82.0	73.9	48.2	55.3	75.5	99.2
Oct. 12.....	126.0	113.9	Mar.	104.1	92.6	71.2	114.4	88.7	83.1	78.9	44.5	54.2	80.4	98.6
Oct. 19.....	128.3	113.6	April	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0	101.7
Oct. 26.....	129.9	116.2	May	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6	101.2
Nov. 2.....	130.2	117.1	Junt	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1	95.8
Nov. 9.....	130.3	117.2	July	102.4	83.5	66.2	110.4	101.1	75.3	63.7	77.1	47.1	67.3	79.9
Nov. 16.....	130.3	117.3	Aug.	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4	85.4
Nov. 23.....	124.7	111.4	Sept.	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.3	83.7
Nov. 30.....	132.6	117.9	Oct.	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2	78.8
Dec. 7.....	132.5	123.9	Nov.	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4	71.0
Dec. 14.....	132.6	124.2	Dec.	....	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.3	64.3

For week ended	National steel rate (%)	Freight car loadings 1000 cars	Electric power output million KWH	Automobile output 1000 units
Jan. 6.....	86.5	592	2,473	87.5
Jan. 13.....	86.0	668	2,593	111.3
Jan. 20.....	84.5	646	2,572	108.5
Jan. 27.....	81.5	649	2,566	106.4
Feb. 3.....	76.5	657	2,541	101.2
Feb. 10.....	71.0	627	2,523	96.0
Feb. 17.....	69.0	608	2,476	95.1
Feb. 24.....	67.0	595	2,455	102.7
Mar. 2.....	65.5	634	2,479	100.9
Mar. 9.....	63.5	621	2,464	103.6
Mar. 16.....	62.5	619	2,460	105.7
Mar. 23.....	62.5	620	2,424	103.4
Mar. 30.....	61.0	628	2,422	103.4
Apr. 6.....	61.5	603	2,381	101.7
Apr. 13.....	61.0	619	2,418	101.9
Apr. 20.....	61.5	628	2,422	103.7
Apr. 27.....	61.5	645	2,398	101.4
May 4.....	63.5	666	2,386	99.3
May 11.....	66.5	681	2,388	98.5
May 18.....	70.0	677	2,422	99.0
May 25.....	75.0	687	2,449	96.8
June 1.....	78.5	639	2,332	61.3
June 8.....	81.5	703	2,453	95.6
June 15.....	86.0	712	2,516	93.6
June 22.....	88.0	728	2,509	90.1
June 29.....	89.0	752	2,514	97.6
July 6.....	75.0	637	2,265	52.0
July 13.....	88.0	740	2,583	65.2
July 20.....	88.0	730	2,524	53.0
July 27.....	89.5	718	2,601	34.8
Aug. 3.....	90.5	718	2,605	17.4
Aug. 10.....	90.5	727	2,589	12.6
Aug. 17.....	90.0	743	2,606	20.5
Aug. 24.....	90.5	761	2,571	23.7
Aug. 31.....	91.5	769	2,601	27.6
Sept. 7.....	82.0	695	2,463	39.7
Sept. 14.....	93.0	804	2,639	66.6
Sept. 21.....	93.0	813	2,629	78.8
Sept. 28.....	93.0	822	2,670	96.0
Oct. 5.....	93.5	806	2,641	105.2
Oct. 12.....	94.5	812	2,665	108.0
Oct. 19.....	95.0	814	2,687	114.7
Oct. 26.....	95.5	838	2,711	117.1
Nov. 2.....	96.5	795	2,734	118.1
Nov. 9.....	96.5	778	2,720	120.9
Nov. 16.....	96.0	745	2,752	121.9
Nov. 23.....	97.0	733	2,695	102.3
Nov. 30.....	97.0	729	2,796	128.8
Dec. 7.....	96.5	739	2,838	124.8
Dec. 14.....	95.5	736	2,862	125.6




ELECTRIC-POWER OUTPUT
COMPILED BY EDISON ELECTRIC INSTITUTE
MILLIONS OF KILOWATT HOURS
1939
1929
COPYRIGHT 1940 STEEL
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

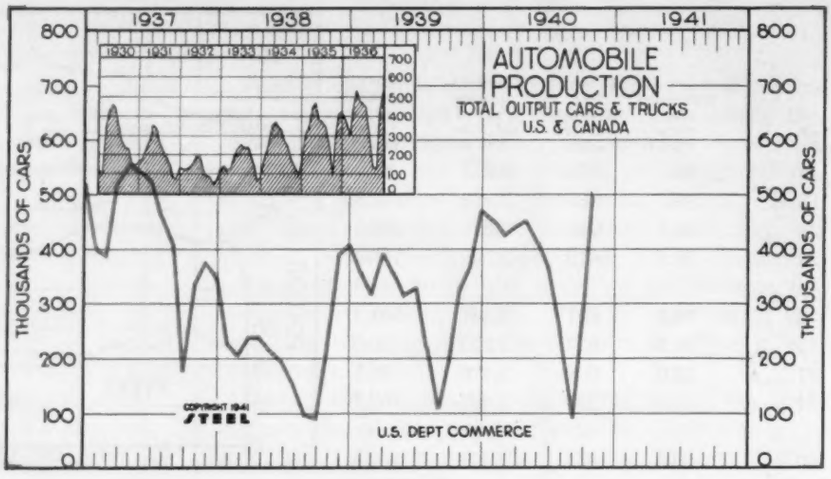


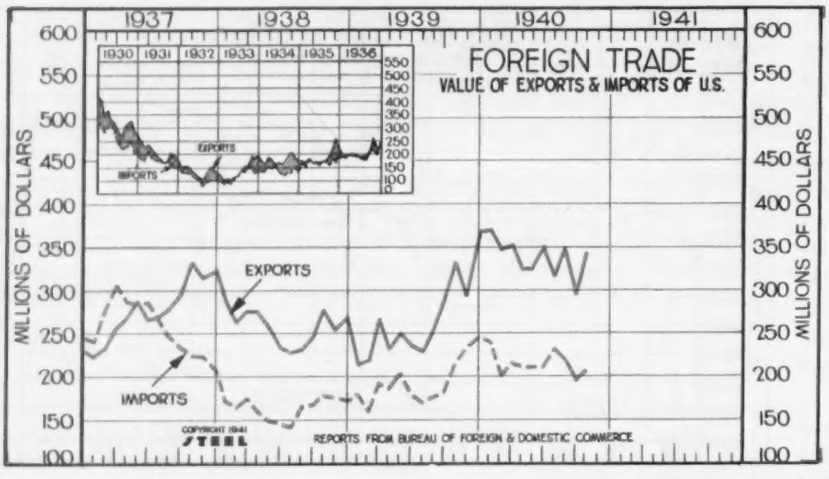


Automobile Production

(Unit: 1000 Cars)

	1940	1939	1938	1937	1936
Jan.	449.3	357.0	227.1	399.2	377.2
Feb.	421.8	317.5	202.6	383.9	300.8
March	440.2	389.5	238.6	519.0	438.9
April	452.4	354.3	238.1	553.4	527.6
May	412.5	313.2	210.2	540.4	480.5
June	362.6	324.2	189.4	521.1	469.4
July	246.2	218.5	150.4	456.9	451.2
Aug.	89.9	103.3	96.9	405.1	275.9
Sept.	284.6	192.7	89.6	175.6	139.8
Oct.	514.4	323.0	215.3	338.0	230.0
Nov.	.....	370.2	390.4	376.6	405.8
Dec.	.....	469.0	407.0	346.9	519.1
Ave.	.....	311.0	221.3	418.0	384.7





United States Foreign Trade

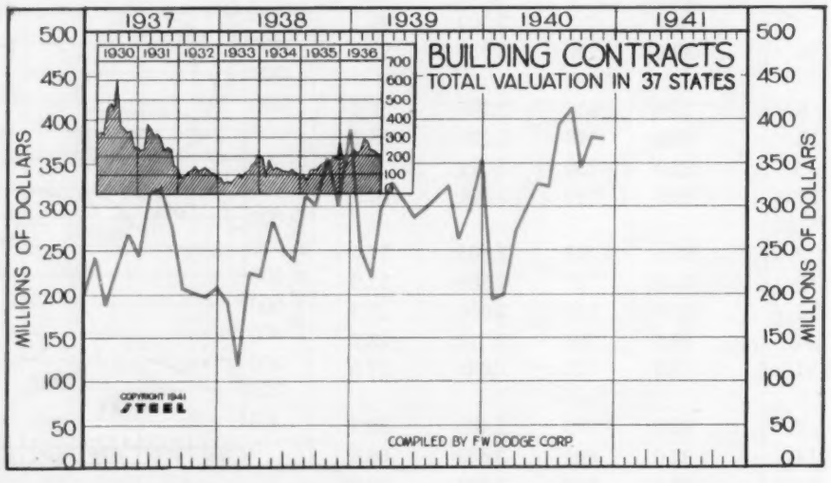
(Unit: $1,000,000)

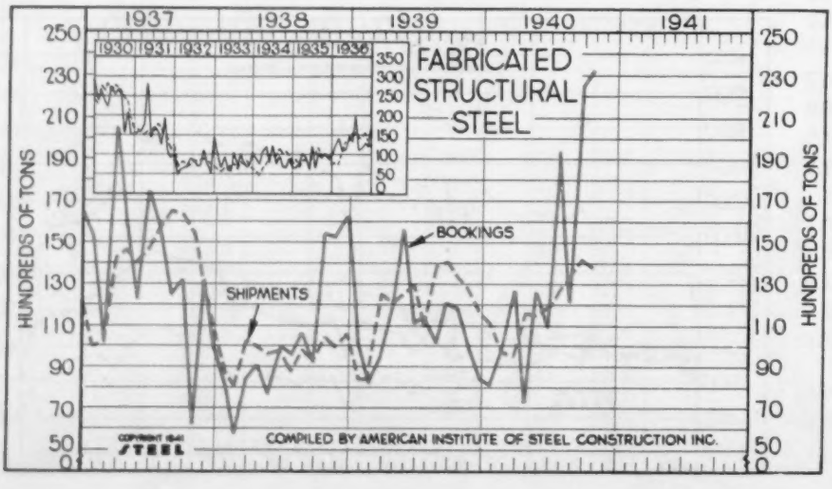
	Exports		Imports	
	1940	1939	1940	1939
Jan.	$368.6	$212.9	$241.9	$178.2
Feb.	347.0	218.6	199.8	158.0
Mar.	352.3	267.8	216.7	190.5
April	324.0	231.0	212.2	186.3
May	325.3	249.5	211.4	202.5
June	350.2	236.1	211.4	178.9
July	317.0	229.6	232.3	168.9
Aug.	349.9	250.8	220.5	175.8
Sept.	295.2	289.0	194.9	181.5
Oct.	343.5	332.1	207.1	215.3
Nov.	.....	292.7	.....	235.4
Dec.	.....	367.8	.....	247.0
Total	.....	$3,177.0	.....	$2,318.3

Construction Total Valuation In 37 States

(Unit: $1,000,000)

	1940	1939	1938	1937	1936
Jan.	$196.2	$251.7	$192.2	$242.7	$204.8
Feb.	200.6	220.2	118.9	188.3	142.1
Mar.	272.2	300.7	226.6	231.2	199.0
April	300.5	330.0	222.0	269.5	234.8
May	328.9	308.5	283.2	243.7	216.1
June	324.7	288.3	251.0	317.7	282.7
July	398.7	299.9	239.8	321.6	294.7
Aug.	414.9	312.3	313.1	281.2	275.3
Sept.	347.7	323.2	300.9	207.1	234.3
Oct.	383.1	261.8	357.7	202.1	225.8
Nov.	380.3	299.8	301.7	198.4	208.2
Dec.	.....	354.1	389.4	209.5	199.7
Ave.	.....	$295.9	$266.4	$242.8	$222.3

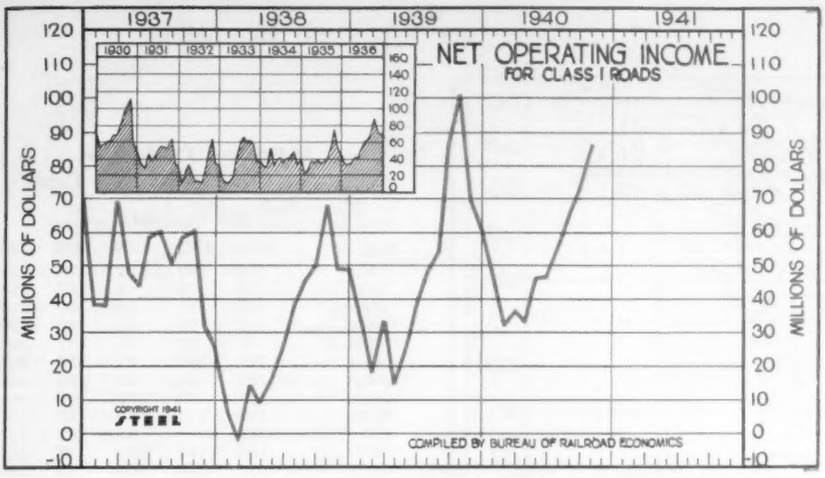




Fabricated Structural Steel

(1000 tons)

	Shipments			Bookings		
	1940	1939	1938	1940	1939	1938
Jan.	110.9	84.3	87.8	81.7	101.7	80.3
Feb.	97.2	84.4	81.2	98.9	82.7	57.1
Mar.	95.9	125.3	103.3	128.3	95.1	84.3
Apr.	116.3	120.9	100.0	73.8	118.3	91.2
May	115.6	125.9	96.4	126.8	156.9	77.3
June	119.1	130.1	98.6	109.7	111.6	99.9
July	127.1	110.5	88.0	194.9	114.1	96.0
Aug.	134.9	139.7	98.6	122.5	100.9	106.8
Sept.	142.8	140.8	93.5	225.5	121.4	92.5
Oct.	139.2	133.8	105.0	233.1	118.8	154.8
Nov.	.....	128.2	99.9	....	99.3	153.1
Dec.	.....	116.2	106.5	....	84.4	163.4
Total	.....	1440.1	1158.8	....	1305.0	1256.6



Class I Railroads
Net Operating Income

(Unit: $1,000,000)

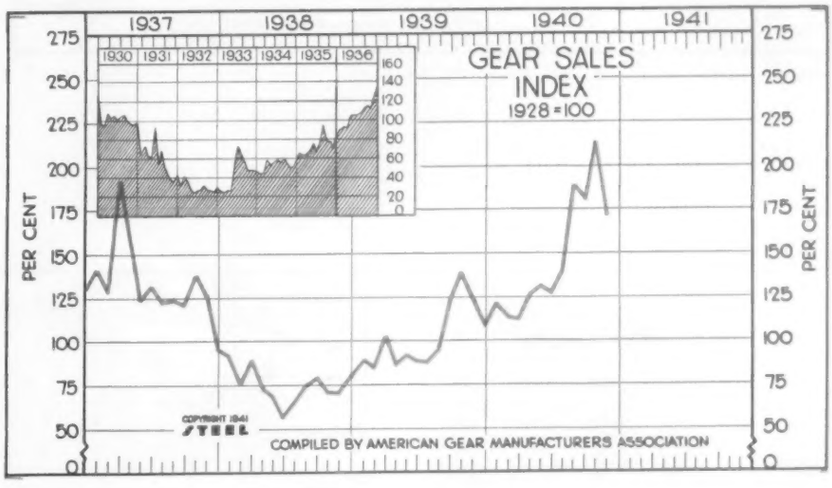
	1940	1939	1938	1937
Jan.	$45.57	$32.89	$7.14	$38.87
Feb.	32.62	18.59	1.91*	38.78
Mar.	36.73	34.32	14.73	69.88
April	33.82	15.32	9.40	48.36
May	47.08	25.10	16.67	44.24
June	47.42	39.10	25.16	59.35
July	57.08	49.01	38.43	60.99
Aug.	66.01	54.59	45.42	50.76
Sept.	74.19	86.43	50.36	59.62
Oct.	86.99	101.62	68.57	60.86
Nov.	.....	70.35	49.67	32.44
Dec.	.....	60.95	49.37	25.99
Average	.....	$49.02	$31.02	$49.18

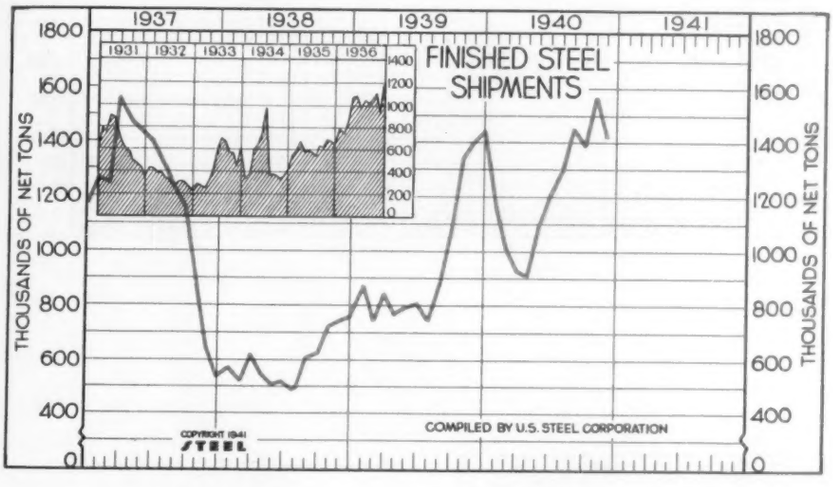
*Indicates deficit.

Gear Sales Index

(1928 = 100)

	1940	1939	1938	1937	1936
Jan.	123	91.0	93.0	144.0	90.5
Feb.	116	86.0	77.0	130.5	93.0
Mar.	114	104.0	91.0	195.0	92.0
April	128	88.0	74.0	164.0	105.0
May	133	93.0	70.0	125.5	105.0
June	129	90.0	58.0	134.0	105.0
July	141	89.0	67.0	124.0	107.5
Aug.	191	96.0	76.5	125.0	113.0
Sept.	183	126.0	80.5	123.0	115.5
Oct.	216	141.0	72.5	139.5	112.5
Nov.	173	126.0	72.0	127.5	122.5
Dec.	...	111.0	81.0	97.0	132.5
Ave.	....	103.5	76.0	135.5	107.5





Finished Steel Shipments
U. S. Steel Corp.

(Unit 1000 Net Tons)

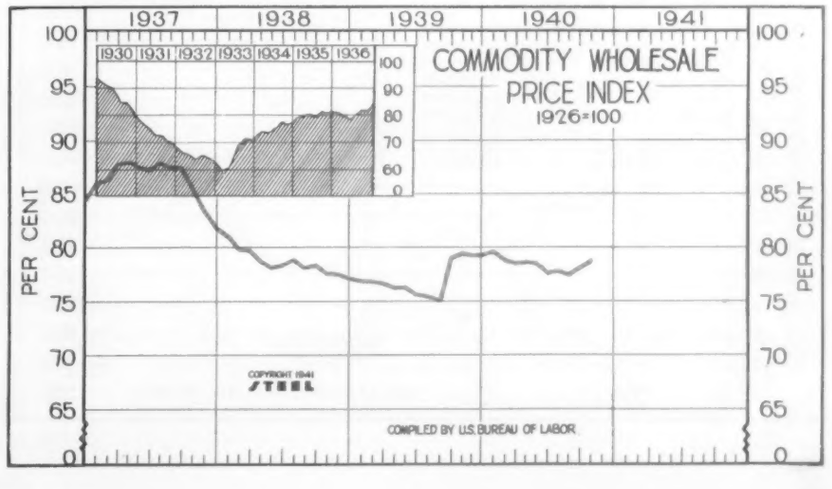
	1940	1939	1938	1937	1936
Jan.	1145.6	870.9	570.3	1268.4	795.2
Feb.	1009.3	747.4	522.4	1252.8	747.4
Mar.	931.9	845.1	627.0	1563.1	863.9
Apr.	907.9	771.8	550.5	1485.2	1080.7
May	1084.1	795.7	509.8	1443.5	1087.4
June	1209.7	807.6	525.0	1405.1	978.0
July	1296.9	745.4	484.6	1315.3	1050.1
Aug.	1455.6	885.6	615.5	1225.9	1019.9
Sept.	1392.8	1086.7	635.6	1161.1	1060.7
Oct.	1572.4	1345.9	730.3	876.0	1109.0
Nov.	1425.4	1406.2	749.3	648.7	947.3
Dec.	.....	1444.0	765.9	539.5	1178.6
Total†	....	11707.3	7315.5	14097.7	11905.0

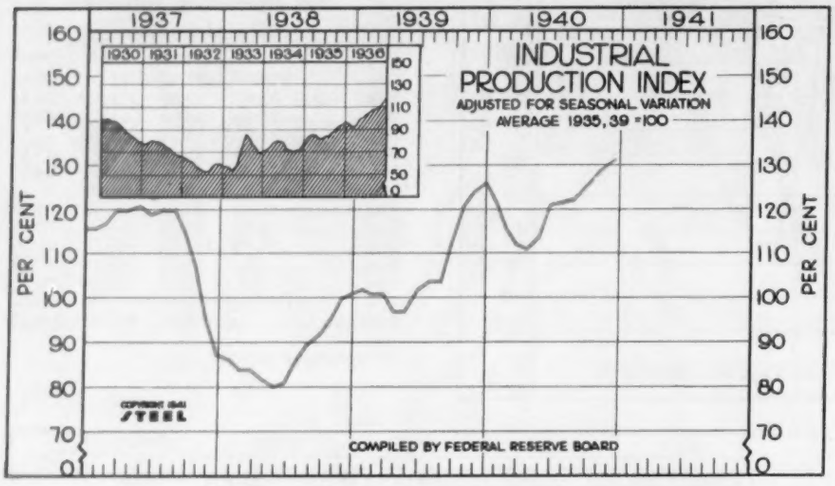
†After year-end adjustments.

All Commodity
Wholesale Price Index
U. S. Bureau of Labor

(1926 = 100)

	1940	1939	1938	1937	1936
Jan.	79.4	76.9	80.9	85.9	80.6
Feb.	78.7	76.9	79.8	86.3	80.6
March	78.4	76.7	79.7	87.8	79.6
April	78.6	76.2	78.7	88.0	79.7
May	78.4	76.2	78.1	87.4	78.6
June	77.5	75.6	78.3	87.2	79.2
July	77.7	75.4	78.8	87.9	80.5
Aug.	77.4	75.0	78.1	87.5	81.6
Sept.	78.0	79.1	78.3	87.4	81.6
Oct.	78.4	79.4	77.6	85.4	81.5
Nov.	....	79.2	77.5	83.3	82.4
Dec.	....	79.2	77.0	81.7	84.2
Ave.	....	77.1	78.6	86.3	80.8





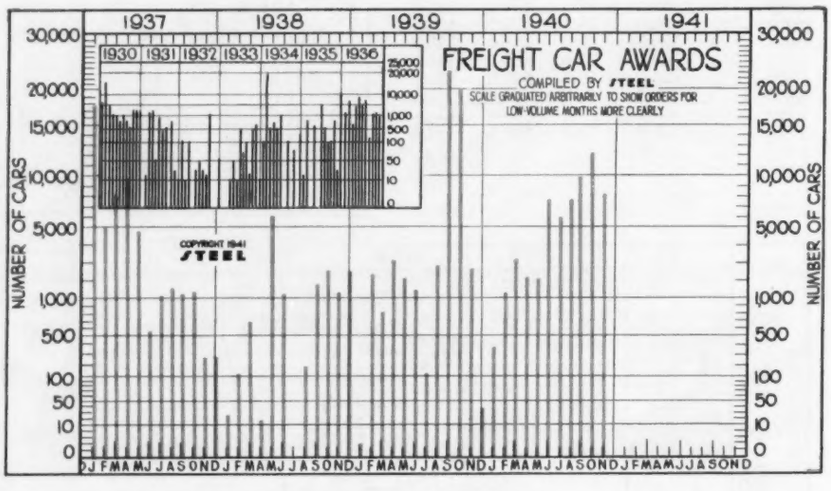
Industrial Production
Federal Reserve Board's Index

(1935-39 = 100)

	1940	1939	1938	1937	1936
Jan.	122	102	86	116	95
Feb.	116	101	84	117	92
March	112	101	84	120	94
April	111	97	82	120	99
May	115	97	80	121	101
June	121	102	81	119	103
July	121	104	86	120	105
Aug.	121	104	90	120	107
Sept.	125	113	92	115	108
Oct.	129	121	95	107	109
Nov.	132	124	100	95	113
Dec.	...	126	101	87	116

Freight Car Awards

	1940	1939	1938	1937
Jan.	360	3	25	17,806
Feb.	1,147	2,259	109	4,972
March	3,104	800	680	8,155
April	2,077	3,095	15	9,772
May	2,010	2,051	6,014	4,732
June	7,475	1,324	1,178	548
July	5,846	110	0	1,030
Aug.	7,525	2,814	182	1,475
Sept.	9,735	23,000	1,750	1,216
Oct.	12,195	19,634	2,537	1,355
Nov.	8,234	2,650	1,232	275
11 mos.	59,731	57,740	13,722	51,336
Dec.	.....	35	2,581	275
Total	.....	57,775	16,303	51,611


1937
1938
1939
1940
1941
1930 1931 1932 1933 1934 1935 1936
FREIGHT CAR AWARDS
COMPILED BY STEEL
SCALE GRADUATED ARBITRARILY TO SHOW ORDERS FOR LOW-VOLUME MONTHS MORE CLEARLY
NUMBER OF CARS
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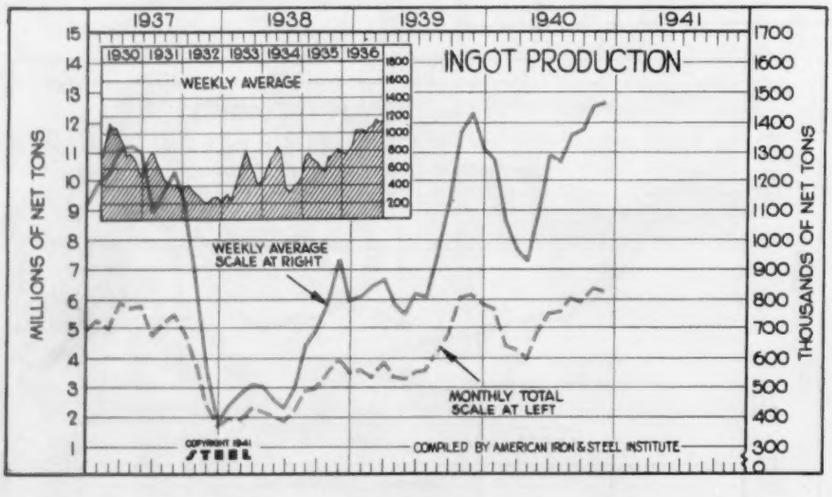


Steel Ingot Production

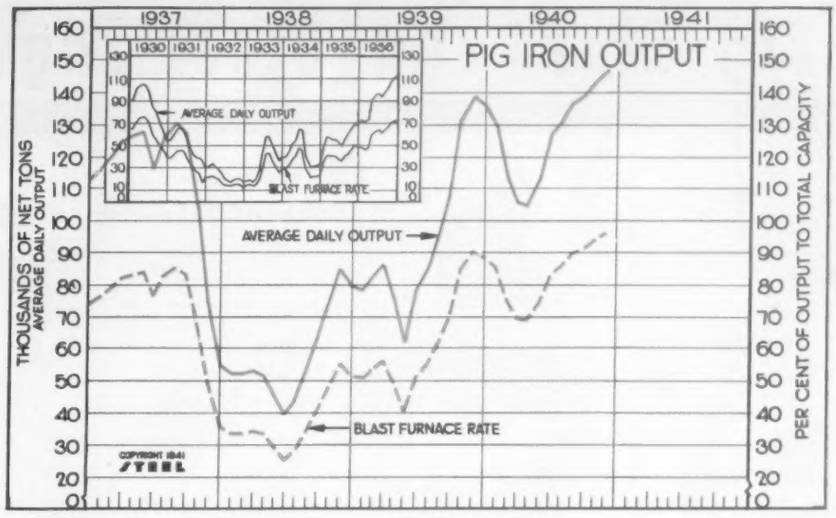
(Unit 100 Net Tons)

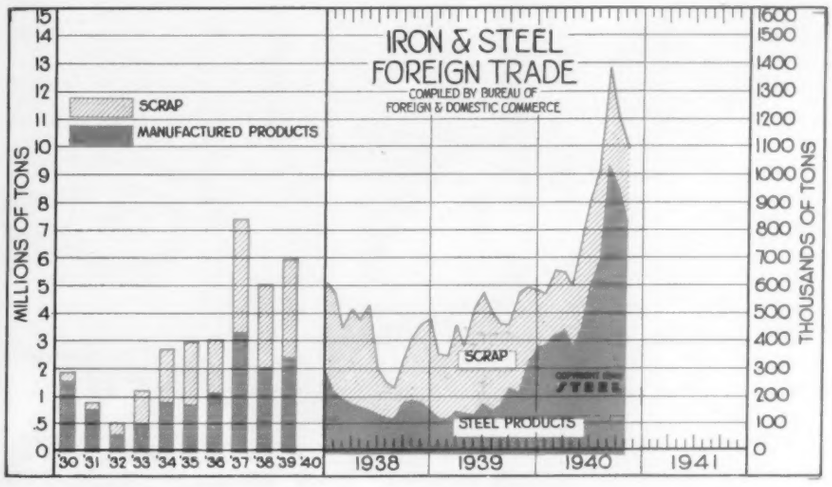
	Monthly Total		Weekly Average	
	1940	1939	1940	1939
Jan.	5,655.3	3,578.9	1,276.6	807.9
Feb.	4,409.0	3,368.9	1,065.0	842.2
Mar.	4,264.8	3,839.1	962.7	866.6
Apr.	3,974.7	3,352.8	926.5	781.5
May	4,841.4	3,295.2	1,092.9	743.8
June	5,532.9	3,523.9	1,289.7	821.4
July	5,595.1	3,564.8	1,265.9	806.5
Aug.	6,033.0	4,242.0	1,361.9	957.6
Sept.	5,895.2	4,769.5	1,377.4	1,114.4
Oct.	6,461.9	6,080.2	1,458.7	1,372.5
Nov.	6,282.8	6,147.8	1,464.5	1,433.0
Dec.	.....	5,822.0	.....	1,317.2
Total	.....	51,585.0	.....	989.4†

†Weekly average.

Pig Iron Production

	Daily average —Net Tons—			Blast furnace —Rate (%)—		
	1940	1939	1938	1940	1939	1938
Jan.	129,825	78,596	52,201	85.4	51.0	33.6
Feb.	113,943	82,407	52,254	75.0	53.5	33.6
Mar.	105,502	86,465	53,117	69.5	56.1	34.2
Apr.	104,635	76,732	51,819	68.9	49.8	33.4
May	112,811	62,052	45,556	74.2	40.2	29.4
June	127,103	79,125	39,601	83.6	51.4	25.5
July	130,984	85,121	43,827	86.1	55.0	28.2
Aug.	136,599	96,122	54,031	89.9	62.4	34.8
Sept.	139,085	107,298	62,835	91.5	69.7	40.5
Oct.	143,152	131,053	74,697	94.2	85.2	48.0
Nov.	146,589	138,883	85,369	96.4	90.3	55.0
Dec.	.....	136,119	79,943	....	88.5	51.4
Av.	.....	86,375	51,752	....	62.6	37.3





Iron and Steel Exports

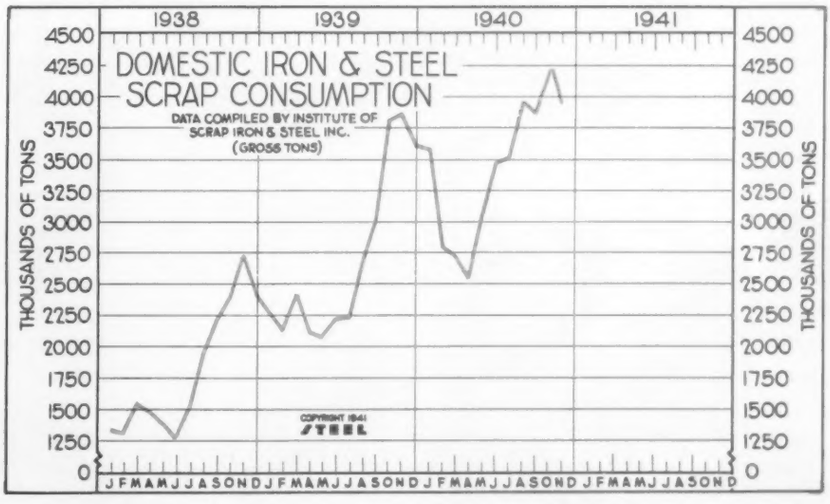
(Thousands of Gross Tons)

	Steel Products		—Scrap—		Total
	1940	1939	1940	1939	1940
Jan.	396.1	134.8	187.5	227.9	583.5
Feb.	436.6	134.8	234.7	224.9	671.3
Mar.	457.1	162.1	206.9	312.3	664.0
April	391.8	153.9	221.2	240.1	612.9
May	471.5	147.8	312.5	384.9	784.0
June	617.7	190.0	318.4	398.9	936.0
July	707.8	163.6	327.1	350.1	1034.9
Aug.	1046.1	185.2	346.1	291.9	1402.1
Sept.	965.4	244.9	251.1	330.7	1221.1
Oct.	846.6	255.1	258.5	336.8	1105.5
Nov.	.....	332.9	.....	272.7	.....
Dec.	.....	394.0	.....	206.4	.....
Total	.....	2,499.0	.....	3,577.4	.....

Iron and Steel Scrap Consumption

(Gross Tons)

	1940	1939 (000 omitted)	1938
Jan.	3,581	2,257	1,331
Feb.	2,812	2,124	1,306
Mar.	2,728	2,419	1,543
Apr.	2,548	2,114	1,477
May	3,061	2,079	1,387
June	3,482	2,221	1,257
July	3,526	2,247	1,520
Aug.	3,968	2,675	1,953
Sept.	3,876	3,018	2,218
Oct.	4,233	3,809	2,393
Nov.	3,922	3,858	2,732
Dec.	.....	3,613	2,411
Total	....	32,434	21,528
Mo. Av.	3,431	2,703	1,794


DOMESTIC IRON & STEEL SCRAP CONSUMPTION
DATA COMPILED BY INSTITUTE OF SCRAP IRON & STEEL INC. (GROSS TONS)
1938
1939
1940
1941
THOUSANDS OF TONS
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
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Pig Iron and Steel Ingot Production

Steel Ingot Figures by American Iron and Steel Institute Coke Pig Iron by STEEL

Pig Iron Production

Net Tons

	Stacks		Output		Stacks		Output		Stacks		Output		Stacks		Output	
	No.	In	Total	Av. daily	No.	In	Total	Av. daily	No.	In	Total	Av. daily	No.	In	Total	Av. daily
			1929				**1934**				**1935**				**1936**	
Jan.....	328	202	3,844,991	124,031	289	86	1,372,720	44,281	281	89	1,655,856	53,415	267	118	2,272,820	73,316
Feb.....	326	208	3,604,581	128,735	289	90	1,423,287	50,831	281	96	1,808,694	64,596	266	120	2,059,604	71,020
March...	326	213	4,154,660	134,021	289	97	1,820,659	58,731	280	97	1,983,509	63,974	265	126	2,291,656	73,924
April....	326	216	4,102,747	136,759	285	109	1,944,563	64,818	278	97	1,872,143	62,405	265	143	2,698,611	89,954
May.....	325	220	4,366,145	140,843	284	117	2,304,367	74,334	275	96	1,943,846	62,704	253	145	2,978,800	96,096
June	325	220	4,160,917	138,697	283	92	2,169,325	72,311	272	91	1,745,479	58,183	253	144	2,908,111	96,937
July.....	325	217	4,236,412	136,658	282	74	1,375,969	44,386	270	92	1,702,781	54,928	252	146	2,907,286	93,783
Aug.....	325	209	4,195,742	135,346	282	61	1,187,409	38,303	270	98	1,970,956	63,579	248	148	3,037,133	97,972
Sept.....	323	204	3,916,029	130,534	282	61	1,006,964	33,565	270	104	1,982,690	66,090	247	154	3,055,648	101,855
Oct.....	318	203	4,018,724	129,637	282	65	1,065,515	34,372	269	116	2,215,784	71,476	245	161	3,350,809	108,090
Nov.....	317	176	3,564,310	118,811	281	60	1,072,855	35,762	268	122	2,314,248	77,141	245	165	3,303,935	110,131
Dec.....	316	156	3,177,347	102,495	281	67	1,151,367	37,140	268	120	2,369,355	76,431	245	170	3,500,215	112,911
Total..			47,342,605	*129,705			17,895,000	*49,027			23,565,341	*64,617			34,364,628	*93,892
			1937				**1938**				**1939**				**1940**	
Jan.....	243	169	3,606,110	116,327	236	91	1,618,245	52,201	237	118	2,436,474	78,596	233	177	4,024,556	129,825
Feb.....	242	176	3,382,407	120,800	236	91	1,463,093	52,254	237	121	2,307,405	82,407	233	157	3,304,368	113,943
March...	242	182	3,886,926	125,385	236	90	1,646,636	53,117	237	123	2,680,446	86,465	233	152	3,270,575	105,502
April....	241	186	3,808,712	126,956	236	79	1,554,569	51,819	236	102	2,301,965	76,732	233	155	3,139,043	104,635
May.....	240	170	3,970,602	128,083	236	73	1,412,249	45,556	236	106	1,923,625	62,052	233	171	3,497,157	112,811
June	240	182	3,489,138	116,304	236	67	1,188,037	39,601	235	117	2,373,753	79,125	232	181	3,813,092	127,103
July.....	237	192	3,921,522	126,501	236	77	1,358,645	43,827	235	129	2,638,760	85,121	231	187	4,060,513	130,984
Aug.....	237	191	4,050,989	130,677	237	88	1,674,976	54,031	235	138	2,979,774	96,122	231	190	4,234,576	136,599
Sept.....	237	181	3,828,115	127,604	237	97	1,885,069	62,835	235	169	3,218,940	107,298	231	192	4,172,551	139,085
Oct.....	237	151	3,237,949	104,450	237	114	2,315,599	74,697	235	188	4,062,670	131,053	231	196	4,437,725	143,152
Nov.....	237	114	2,247,875	74,929	236	121	2,561,060	85,369	235	191	4,166,512	138,883	231	202	4,397,656	146,589
Dec.....	237	93	1,683,891	54,319	236	115	2,478,244	79,943	233	191	4,219,718	136,119	...	...	.....	.....
Total..			41,114,236	*112,642			21,156,422	*57,962			35,310,042	*96,740			†42,351,812	*126,423

*Average. †Eleven months.

Steel Ingot Production and Operating Rates

Net Tons

	1929		% of	1934		% of	1935		% of	1936		% of
	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity
Jan.....	5,040,147	1,137,731	86.84	2,236,785	504,917	34.33	3,214,580	725,639	49.06	3,404,581	768,528	52.39
Feb.....	4,848,159	1,212,039	92.51	2,477,377	619,344	42.10	3,107,184	776,796	52.52	3,311,718	799,932	54.53
March...	5,676,357	1,281,345	97.80	3,134,253	707,506	48.10	3,209,127	724,408	48.98	3,733,915	842,871	57.46
April....	5,544,059	1,292,322	98.64	3,288,392	766,525	52.11	2,957,474	689,388	46.61	4,404,518	1,024,344	69.99
May.....	5,920,596	1,336,478	102.01	3,807,433	859,466	58.43	2,949,700	665,847	45.02	4,521,860	1,020,736	69.58
June	5,491,310	1,280,026	97.70	3,426,621	798,746	54.30	2,529,704	589,674	39.87	4,452,637	1,037,911	70.75
July.....	5,432,653	1,229,107	93.82	1,668,187	377,418	25.66	2,539,966	574,653	38.86	4,384,094	991,876	67.61
Aug.....	5,531,776	1,247,708	95.31	1,547,112	349,235	23.74	3,265,842	737,210	49.85	4,686,401	1,057,878	72.11
Sept.....	5,071,233	1,184,868	90.44	1,421,254	332,069	22.57	3,164,004	739,254	49.99	4,649,555	1,086,344	74.05
Oct.....	5,078,445	1,146,376	87.50	1,659,730	374,657	25.47	3,519,890	794,557	53.72	5,078,356	1,146,356	78.15
Nov.....	3,943,644	919,265	70.17	1,803,900	420,489	28.59	3,528,458	822,484	55.61	4,841,788	1,128,622	76.94
Dec.....	3,251,373	735,605	56.15	2,199,968	497,730	33.84	3,442,214	778,781	52.66	4,955,291	1,121,107	76.42
Total..	60,829,752	1,166,661	89.05	28,671,012	549,885	37.38	37,428,143	717,839	48.54	52,424,714	1,002,768	68.36

	1937		% of	1938		% of	1939		% of	1940		% of
	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity
Jan.....	5,284,648	1,192,923	81.32	1,942,265	438,434	29.17	3,578,863	807,870	52.83	5,655,315	1,276,595	84.11
Feb.....	4,944,463	1,236,116	84.27	1,901,146	475,287	31.63	3,368,915	842,229	55.07	4,409,035	1,064,984	70.16
March...	5,844,525	1,319,306	89.94	2,244,708	506,706	33.72	3,839,127	866,620	56.67	4,264,755	962,699	63.42
April....	5,679,371	1,323,862	90.25	2,149,327	501,008	33.34	3,352,774	781,532	51.11	3,974,706	926,505	61.04
May.....	5,770,138	1,302,514	88.79	2,016,982	455,301	30.30	3,295,164	743,829	48.64	4,841,403	1,092,867	72.0
June	4,686,890	1,092,515	74.48	1,828,784	426,290	28.36	3,523,880	821,417	53.71	5,532,910	1,289,723	84.9
July.....	5,103,060	1,154,539	78.48	2,211,235	500,279	33.29	3,564,827	806,522	52.74	5,595,070	1,265,853	83.4
Aug.....	5,463,165	1,233,220	83.83	2,841,554	641,434	42.68	4,241,994	957,561	62.62	6,033,037	1,361,859	89.7
Sept.....	4,804,248	1,122,488	76.30	2,964,785	692,707	46.09	4,769,468	1,114,362	72.87	5,895,232	1,377,391	90.7
Oct.....	3,800,075	857,805	58.31	3,478,703	785,260	52.25	6,080,177	1,372,500	89.75	6,461,898	1,458,668	96.1
Nov.....	2,412,889	562,445	38.23	3,985,367	928,990	61.81	6,147,783	1,433,050	93.71	6,282,824	1,464,528	96.4
Dec.....	1,649,784	373,255	25.37	3,506,436	793,312	52.79	5,822,014	1,317,198	86.13	.....	.....	.....
Total..	55,443,256	1,063,354	72.38	31,071,292	595,921	39.65	51,584,986	989,355	64.70	‡58,946,185	*1,231,638	81.1

Compiled by American Iron and Steel Institute. †Beginning with 1927 the Institute excludes crucible and electric ingots, which totaled 756,138 net tons in 1927, 907,232 tons in 1928, 1,073,045 tons in 1929, 688,634 tons in 1930, 461,987 tons in 1931, 270,766 tons in 1932, 47,510 tons in 1933, 405,246 tons in 1934, 607,190 tons in 1935, 866,063 tons in 1936, 913,073 tons in 1937, 524,850 tons in 1938, 952,453 tons in 1939. ‡Eleven months. *Average.

Ferro-Alloys

Ferro-Silicons

Ferro-Manganese

Simanal

H.C. Ferro-Chrome

Silico-Manganese

Ohio Ferro-Alloys Corporation
Canton, Ohio

Average Monthly Quotations in 1940

Base or Furnace, Unless Otherwise Specified; Scrap, Delivered to Consumers

PITTSBURGH

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Structural Shapes	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold-Finished Steel Bars	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
Strip, Hot-Rolled	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Strip, Cold-Rolled	2.80	2.80	2.80	2.70	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Standard Spikes	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Plain Wire	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
Structural Rivets	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
Hot Rolled Sheets	2.10	2.10	2.10	2.00	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
No. 24 Galvanized Sheets	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Tin Plate, base box	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Wire Nails	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Steel Pipe, 1 to 3-inch, %discount (base $200 per ton)	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%
Bessemer Pig Iron, Neville Island base	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$24.00
Basic Pig Iron, Neville Island base	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	23.00
No. 2 Foundry Pig Iron, Neville Island Base	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
Malleable Pig Iron, Neville Island base	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
Bessemer Ferrosilicon, 10 per cent (Jackson co. base)	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	23.50
Billets, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Sheet Bars, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Wire Rods	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Furnace Coke, spot	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$5.00
Foundry Coke, spot	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	6.00
Heavy Melting Steel Scrap	18.15	17.75	17.05	16.45	18.00	19.90	19.55	18.75	20.15	21.30	21.50	22.50
Low Phosphorus Scrap	24.50	22.50	21.50	21.50	22.50	24.75	25.30	25.00	25.80	27.75	28.00	28.00
No. 1 Cast Scrap	18.50	18.00	17.50	17.50	18.15	19.65	19.80	19.00	19.30	20.25	20.75	22.50

CHICAGO

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bars	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Structural Shapes	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Rail Steel Bars	2.15	2.15	2.075	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.10	2.10
Bar Iron	2.15	2.15	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Cold Rolled Sheets	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
No. 2 Foundry and Malleable Pig Iron	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.50
Southern No. 2 Pig Iron, Delivered	23.22	23.22	23.22	23.22	23.22	23.22	23.22	23.22	23.22	23.22	23.22	23.72
Lake Superior Charcoal Iron, Delivered, Chicago	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.84
Heavy Melting Steel Scrap	$16.45	$15.75	$15.50	$15.25	$16.65	$18.00	$17.45	$18.15	$19.30	$19.85	$20.25	$20.60
Steel Specialties, Chicago	18.50	18.50	18.40	18.05	19.75	21.40	21.00	21.05	21.65	23.25	23.25	23.75
Rails for Rolling	19.05	18.25	18.25	18.65	20.45	22.25	21.65	22.00	21.40	24.05	24.55	24.75
Car Wheels, Iron	17.25	17.15	17.15	16.75	18.05	18.75	18.75	20.00	20.00	20.65	21.50	21.50
No. 1 Machinery Cast Scrap	14.85	14.50	14.55	14.90	15.75	16.65	16.95	16.75	16.90	17.55	18.25	18.50

EASTERN PENNSYLVANIA

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tank Plates, delivered Philadelphia	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Structural Shapes, delivered Philadelphia	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½
Steel Bars, delivered Philadelphia	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
Bar Iron, common, delivered Philadelphia	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
Hot Rolled Sheets, delivered Philadelphia	2.27	2.27	2.27	2.12	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27
Basic Pig Iron, delivered	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.84
No. 2X Foundry Pig Iron, delivered Philadelphia	25.215	25.215	25.215	25.215	25.215	25.215	25.215	25.215	25.215	25.215	25.215	25.715
Standard Low Phosphorus Pig Iron, delivered	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	30.24
No. 1 Heavy Melting Scrap	18.15	17.50	17.15	16.75	17.40	19.65	19.05	19.75	20.70	20.75	20.75	20.75
No. 1 Railroad Wrought Scrap	18.75	18.25	18.25	18.25	18.65	20.15	20.00	20.05	20.25	20.25	20.25	20.25
No. 1 Cupola Cast Scrap	20.75	19.75	19.70	19.70	20.40	21.65	21.50	21.65	22.25	22.50	22.95	23.25
Spiegeleisen, 20%	32.00	32.00	32.00	32.00	32.00	32.00	36.00	36.00	36.00	36.00	36.00	36.00
Ferromanganese, delivered Pittsburgh	105.33	105.33	105.33	105.33	105.33	105.33	125.33	125.33	125.33	125.33	125.33	125.33

COAL TAR PRODUCTS

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Benzol, per gallon producers' plants, tank lots	16.00c	16.00c	16.00c	16.00c	16.00c	15.00c	15.00c	15.00c	15.00c	15.00c	14.00c	14.00c
Toluol, two degree, per gallon producers' plants, tank lots	25.00	25.00	25.00	25.00	25.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Solvent naphtha, per gallon producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Xylol, per gallon producers' plants, tanklots	27.00	27.00	27.00	27.00	27.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Naphthalene, flakes and balls, per pound, producers' plants	6.75	6.75	6.75	6.75	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Phenol, per pound producers' plants, 1000 pounds or less	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	13.75	13.75
Sulphate of ammonia, per ton bulk f.o.b. Atlantic seaboard	$28.00	$28.00	$28.00	$28.00	$28.00	$28.00	$29.00	$29.00	$29.00	$29.00	$29.00	$30.00

NONFERROUS METALS

Prompt wholesale prices in cents per pound

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tin, Straits, spot, New York	46.740	45.853	47.145	46.834	51.625	54.570	51.596	51.207	50.335	51.505	50.583	50.100
Copper, electrolytic, delivered, Connecticut	12.216	11.418	11.390	11.332	11.319	11.365	10.815	10.940	11.536	12.000	12.000	12.000
Zinc, prime western, East St. Louis	5.644	5.543	5.750	5.750	5.808	6.240	6.250	6.398	6.938	7.250	7.250	7.250
Lead, open market, East St. Louis	5.321	4.926	5.044	4.921	4.865	4.850	4.850	4.704	4.779	5.156	5.578	5.350
Lead, open market, New York	5.471	5.076	5.194	5.071	5.015	5.000	5.000	4.854	4.929	5.306	5.728	5.500
Aluminum, ninety-nine per cent plus	20.000	20.000	19.760	19.000	19.000	19.000	19.000	18.000	18.000	18.000	17.522	17.000
Antimony, American, spot, New York	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000
Nickel, cathodes	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000

1940 a Peak in Steel Exports

■ STEEL and iron exports from the United States reached new peaks in 1940. Estimate of shipments for the year, based on figures for ten months by the metals and minerals division, department of commerce, is close to 11,000,000 gross tons, including 8,000,000 tons of iron and steel and 3,000,000 tons of scrap.

Influence of the European war became more apparent in 1940. Entrance of Italy into the struggle, the downfall of Belgium and France, and absorption of their steelmaking capacity by Germany, brought an entirely new alignment in world trade.

Exports to a number of countries in the first ten months increased tremendously over 1939, as shown in the following table:

(Gross Tons, Excluding Scrap)

	January through October	
	1940	1939
United Kingdom	2,724,453	110,193
Canada	730,330	273,648
Japan	292,981	129,199
Union South Africa	159,163	38,360
Argentine	334,453	22,792
Total, all countries	6,336,535	1,772,069

Practically all export items participated in the increased tonnage. Exports of leading products for first ten months:

	1940	1939
Ingots, blooms	1,977,110	110,478
Pig iron	465,777	121,494
Cold-finished bars	38,096	7,545
Steel bars	401,460	99,685
Wire rods	248,635	20,394
Plates	438,631	196,523
Shapes	330,209	90,128
Rails	195,485	34,218

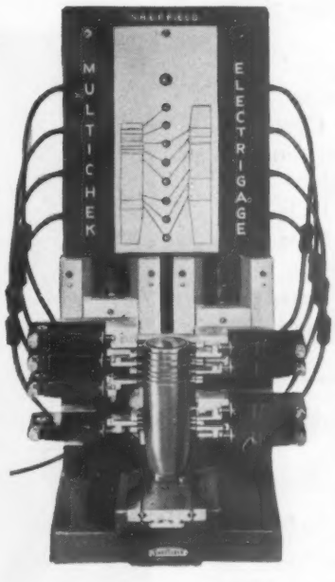
Scrap exports in 1940 were less than in the preceding year, 2,678,759 tons in ten months, against 3,098,369 tons in the same period in 1939. Two factors brought this result, entry of Italy into the European war and embargo against shipments to Japan, the former in June and the latter Oct. 15, which shut off two important export channels. Scrap shipments to leading consumers, for first ten months:

	1940	1939
United Kingdom	875,853	457,983
Japan	962,772	1,720,776
Italy	320,923	384,605
Canada	335,240	140,334

Industrial machinery exports, an important item in foreign trade, reached a value of $358,362,075, in ten months, 1940, according to the machinery division, department of commerce, compared with $239,201,473 in the corresponding period in 1939. This is believed to be the highest mark ever attained, exceeding $277,764,507 for all of 1929.

They SHALL NOT PASS

Unless every one of the eight critical dimensions of this 75 mm. shell checks within prescribed limits, it does not pass this guardian of quality. Six hundred an hour of these shell bodies are thus checked on the Sheffield Multichek Electrigage pictured at the left. In a flash the inspector knows whether each shell body is acceptable or not.



The slightest variation beyond tolerance limits is flashed by a colored signal light on the control board above the Electrigage head. The color of the light indicates whether the dimension is oversize or undersize. And the position of the colored flash indicates just which dimension or dimensions are incorrect. If all dimensions are correct the master signal at the top of the board so indicates. Then it is unnecessary to read individual signals.

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SHEFFIELD
GAGE CORPORATION • DAYTON, OHIO, U.S.A.
MASTER GAGEMAKERS

Steel "Ample" for Long Pull

Germany Controls 55 Per Cent of Continent's Output. Capacity in 1941 To Be Greater Than in 1939. Britain's Sea Power Assures Necessary Imports. Productive Facilities Little Damaged by Raids.

LONDON

■ DESPITE the great odds against which she is operating, Great Britain can be assured of a sufficient supply of steel to enable her to pursue to the end the war in which she is engaged.

Steel is one of the sinews of war—more important than gold. A year or more before the European war started the would-be combatant nations had already begun to intensify their production and reorganize their steel industries, tending more and more to place it under government control. From the beginning of the war and throughout 1940 steel output accelerated and control of the industry further tightened.

That the steel output of Great Britain and Germany, and of France, Belgium and Luxemburg up to the time of the invasion of the Low Countries in the early part of May, did increase is certain, but no statistics of production are available since July, 1939, for the main countries concerned. It is possible, however, to observe the fluctuations of the relative steel capacities available to the opposing sides by taking into account their individual capacities and their output in 1937 and 1938 (actual) and 1939 (estimated). The year 1937 is included because it was a year of record production. These figures are summarized in the accompanying tables.

With regard to Table I, it may be noted that Russia's capacity of steel production is likely to increase substantially in the course of the next few years, and at a much quicker rate than appears possible in other European countries. This is due to the five-year development plan reported in STEEL, Sept. 2, 1940. Germany's capacity, normally, would increase also with the gradual construction and putting into operation of the Hermann Goering works program

Europe's Production, Capacity

TABLE I

(Steel ingots, castings in gross tons)

	Estimated Capacity†	Output in 1939 (Estimated)‡	Output in 1938	Output in 1937
Germany*	26,000,000	24,000,000	22,922,000	19,531,000
Russia	19,000,000	18,500,000	18,150,000	17,493,000
Great Britain	14,700,000	13,500,000	10,398,000	12,984,000
France	10,000,000	8,400,000	6,087,000	7,793,000
Belgium	4,300,000	3,000,000	2,248,000	3,801,000
Luxemburg	2,800,000	1,800,000	1,414,000	2,470,000
Italy	2,500,000	2,350,000	2,286,000	2,054,000
Poland**	2,100,000	1,600,000	1,517,000	1,420,000
Czechia	1,750,000	1,250,000	1,733,000	2,281,000
Sweden	1,300,000	1,100,000	963,000	1,088,000
Hungary	750,000	750,000	638,000	654,000
Spain	500,000	500,000	465,000	100,000
Rumania	250,000	250,000	250,000	220,000

* Including Austria. ** Within boundaries existing before present war. †See STEEL, Sept. 2, 1940. ‡See STEEL, Jan. 1, 1940.

...European War

By Vincent Delport

European Editor, STEEL

at Salzgitter, Germany, and in subjected Austria.

Table II gives the picture of the gains and losses made by the opposing sides through the fortunes of war. When hostilities began, at dawn on Sept. 1, 1939, with Germany invading Polish territory, Germany had at her disposal her own vast steel resources with the output of Austria, and she was in a position to control the steelworks of Bohemia-Moravia, the industrial provinces of the former republic of Czecho-slovakia, whose independence she had violated in March, 1939.

Combined resources of the allied nations, Great Britain, France and Poland, with an aggregate steel output of 23,500,000 tons, nearly equalled the production controlled directly or indirectly by Germany.

Combined output of the European neutral nations was slightly in excess of the tonnage available to either of the two opposing parties. Russia alone produced 18,500,000 tons of the neutral output.

This situation obtained until the acceptance of armistice terms by Poland on Sept. 27, 1939. From that date, Polish steel was no more to be used for the defense of democracies, but was eventually to add its quota to Germany's assets. The estimated figures of 1939 production shown in Tables I and II take into account, as far as possible, the fact that production must have suffered some interruption in works belonging to either side, which were situated in the actual war zone.

During the first period of the war, up to Poland's defeat, which lasted less than a month, the nations at war had the necessary supplies of essential raw materials. Germany had a surplus of coal and coke. Poland was also well provided, and Great Britain had enough to meet her own requirements and help France, who was not so well placed as regards metallurgical coke.

The iron ore situation was satisfactory, on the whole, for the allied nations, and Germany had the necessary resources to start with as she had accumu-

■ **Typical British steelworker swings glowing shell blank from a heating furnace. Nearly all metalworking plants have switched to multiple-shift production of armaments. NEA photo**

Steel Available to Opposing Sides

TABLE II

(Gross Tons, Estimated, 000 omitted)

Annual Output, Produced or Controlled by:	As at Sept. 1, 1939(a)	Sept. 27, 1939 to June 22, 1940(a)	June 22 to Dec. 31, 1940 Based on estd. output, 1939	June 22 to Dec. 31, 1940 Based on estd. capacity
Germany	25,250(b)	26,850(e)	42,650(g)	49,700(g)
Great Britain and Allies	23,500(c)	21,900(f)	13,500	14,700
Neutral Countries	28,250(d)	28,250(d)	20,850(h)	21,550(h)

(a) Based on estimated output of 1939. (b) Includes Austria and Czecho-Slovakia. (c) Includes France and Poland. (d) Includes Belgium, Luxemburg, Italy, Spain, Sweden, Hungary, Russia, Rumania. (e) Now includes Poland. (f) Less Poland. (g) Includes Italy and countries under occupation. (h) Includes Russia, Sweden, Hungary, Spain.

■ Shrapnel undergoing examination in a German factory. The cover is tested with a hammer before being loaded with explosives. Many women are engaged in such tasks. Wide World photo

lated large stocks of imported ore and had intensified her own production. The British sea blockade, however, was bound to cause considerable anxiety to Germany concerning her imports of ore, which constituted over two-thirds of her consumption; this aspect of the question was covered among others in STEEL, Jan. 1, 1940. During this period both Germany and the Allies endeavored to supplement their own resources with imports of raw materials and steel from the neutral countries, with more or less success.

We now come to the second period shown in Table II, which extends to the early summer of 1940, from Poland's downfall to the invasion of Belgium and Holland and the capitulation of France on June 22. This period also covers the Norwegian campaign.

On Sept. 29, 1939, Germany and Soviet Russia signed a treaty by which they divided Poland between themselves. This gave to Germany the industrial part of Poland with its resources in coal and its iron and steelworks which, at that time, were producing at the rate of 1,600,000 tons a year. It can therefore be said that from that date Germany could add this tonnage to that which she already had under control.

This situation is indicated in Table II, with a corresponding reduction in allied resources, the neutral countries maintaining their previous position. The cession of Polish coal mines to Germany was of interest only insofar as they were used for the operation of the Polish and Czech works; Germany did not need additional coal and coke resources for her own iron and steelworks.

As time went on, Germany felt increasing apprehension in regard to her future ore supplies. The victory over Poland had not improved the situation in that respect, and the British blockade effectively stopped adequate deliveries by sea from Spain and North Africa, and also from Sweden, Germany's principal outside source of supply.

Scandinavian Compaign Disrupts Ore Shipments

Swedish ore reaches Germany in two ways—from the port of Lulea north of the Gulf of Bothnia, which is ice-bound for seven months of the year, and from the port of Narvik on the Atlantic coast of Norway, which is open in the winter. Thus, in the winter months of 1939-40 Germany depended on Narvik and the British saw to it that this route should be blocked to the maximum. Actually, it was stated by the ministry of economic war that in the three months December-February 1939-40, 478,058 tons of Swedish ore were shipped to Germany from Narvik, against 1,286,181 tons in the corresponding period of 1938-39. At the same time, Britain continued to receive tonnages of ore that she required from Sweden, and France had her own vast resources.

The Russo-Finnish campaign, which started on Nov. 30, 1939, and ended so disastrously for the innocent victim on March 13, 1940, had but little influence on the steel situation of the main combatants, the only possible effect being that while this outgrowth of the major war was following its course, Soviet Russia was less likely than at any other time to disperse her resources in favor of Germany, with whom she had an economic agreement.

Invasion of Denmark and Norway by Germany, which began in the early hours of April 9, had the temporary effect of further interfering with shipments of Swedish ore to Germany. Although the Swedish port of Lulea would soon be available for loading ore for shipment down the Gulf of Bothnia and the Baltic sea, transport was hindered by war activities down to the end of the Norwegian campaign. From May 3, after the evacuation of the Allies from Namsos, fighting was continued in the Narvik district, which was finally evacuated on June 9-10.

The Germans then gained full control of Norway, but the railroad used for bringing ore from the Swedish fields to Narvik was seriously damaged, and before leaving Narvik the Allies had wrecked the harbor and its loading equipment, so that this ore route to Germany should be unavailable for a long time to come. In any case, the British would no longer be restricted in their blockade measures since Norwegian neutrality was no more to be respected.

In the meantime, Germany's invasion of Holland, Belgium and Luxemburg had started, on May 10, and this was the beginning of a period of considerable difficulty for British steelworks, because the supply of Belgian and Luxemburg steel, a considerable tonnage of which was imported into Britain, began to dwindle. During the first days of the campaign, some

Belgian steel could still add its quota to French tonnages and be shipped across the Channel from Dunkirk, but as the advancing invader spread his grip over Northern France in the direction of the Channel ports, all supplies of continental steel to Britain were stopped.

Exactly a month after the Germans had begun to cross the Dutch, Belgian and Luxemburg frontiers, on June 10, Mussolini declared war on Britain and France. This added more to Britain's difficulties owing to the effect that a hostile Mediterranean would have on ore shipments from that quarter. It may be recalled here that in the last prewar year of 1938, Britain imported 5,104,351 tons of iron ore, of which 2,542,094 tons or 50 per cent, came from Mediterranean ports.

When France capitulated, on June 22, all hope of receiving further ore supplies from France, Algeria, Tunis, were lost to Britain; in 1938 these territories contributed 2,110,840 tons to British imports.

We have arrived at the fatal date of June 22, when France had lost the war, and Britain stood alone to face the enemy, to save herself from the fate that had befallen weaker countries. The British people accepted this task, to maintain their own freedom, at the same time determined to liberate the defeated

World Production of Steel Ingots and Castings

Gross Tons

	1940*	1939	1938	1937	1936	1935	1934	1933	1932	1929
United States...	60,220,823	47,672,195	28,693,000	51,526,000	48,525,000	34,467,000	26,502,000	23,232,000	13,681,000	56,433,000
Canada	1,985,000	1,300,000	1,156,000	1,352,000	1,078,000	915,000	741,000	403,000	335,000	1,391,000
Great Britain...	.....	13,500,000	10,398,000	12,984,000	11,785,000	9,859,000	8,850,000	7,024,000	5,261,000	9,636,000
France	.....	8,400,000	6,087,000	7,793,000	6,601,000	6,177,000	6,075,000	6,427,000	5,550,000	9,544,000
Belgium	.....	3,000,000	2,248,000	3,801,000	3,117,000	2,975,000	2,901,000	2,687,000	2,745,000	4,066,000
Luxemburg	.....	1,800,000	1,414,000	2,470,000	1,949,000	1,808,000	1,901,000	1,815,000	1,925,000	2,659,000
Italy	.....	2,350,000	2,286,000	2,054,000	1,992,000	2,174,000	1,820,000	1,755,000	1,369,000	2,109,000
Spain	.....	500,000	465,000	100,000	365,000	555,000	635,000	498,000	525,000	985,000
Sweden	.....	1,100,000	963,000	1,088,000	962,000	882,000	848,000	620,000	520,000	683,000
Germany*	.....	24,000,000	22,922,000	19,531,000	18,900,000	16,184,000	11,725,000	7,690,000	5,678,000	15,986,000
Austria	.....	.....	.....	640,000	411,000	358,000	304,000	222,000	201,000	622,000
Czechia	.....	1,250,000	1,733,000	2,281,000	1,463,000	1,135,000	938,000	749,000	662,000	2,103,000
Poland	.....	1,600,000	1,517,000	1,420,000	1,123,000	930,000	831,000	805,000	542,000	1,355,000
Hungary	.....	750,000	638,000	654,000	543,000	439,000	310,000	224,000	177,000	505,000
Russia	.....	18,500,000	18,150,000	17,493,000	16,080,000	12,320,000	9,412,000	6,790,000	5,900,000	4,828,000
Japan†	.....	6,300,000	6,000,000	5,718,000	5,174,000	4,858,000	3,682,000	3,150,000	2,300,000	2,249,000
India	.....	1,000,000	966,000	895,000	866,000	862,000	798,000	694,000	570,000	575,000
Australia	.....	1,200,000	1,151,000	1,074,000	750,000	697,000	518,000	393,000	221,000	460,000
Saar‡	.....	.....	.....	.....	.....	.....	1,919,000	1,649,000	1,440,000	2,174,000
Miscellaneous ...	.....	900,000	900,000	900,000	800,000	750,000	450,000	350,000	300,000	400,000
World total.....	.....	134,983,000	107,687,000	133,774,000	122,484,000	98,345,000	81,160,000	67,177,000	49,902,000	118,763,000

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.

World Production of Pig Iron and Ferroalloys

Gross Tons

	1940*	1939	1938	1937	1936	1935	1934	1933	1932	1929
United States...	42,316,828	31,943,000	19,161,000	37,127,000	31,029,000	21,373,000	16,139,000	13,346,000	8,781,000	42,614,000
Canada	1,270,000	800,000	758,000	979,000	747,000	655,000	438,000	258,000	160,000	1,160,000
Great Britain...	.....	8,200,000	6,761,000	8,493,000	7,721,000	6,424,000	5,969,000	4,136,000	3,574,000	7,589,000
France	.....	7,800,000	5,964,000	7,787,000	6,130,000	5,696,000	6,053,000	6,223,000	5,448,000	10,198,000
Belgium	.....	3,000,000	2,426,000	3,743,000	3,110,000	2,982,000	2,860,000	2,667,000	2,705,000	4,030,000
Luxemburg	.....	1,750,000	1,526,000	2,473,000	1,955,000	1,842,000	1,968,000	1,858,000	1,929,000	2,860,000
Italy	.....	1,000,000	913,000	849,000	793,000	683,000	564,000	544,000	481,000	718,000
Spain	.....	500,000	435,000	126,000	250,000	350,000	365,000	334,000	296,000	740,000
Sweden	.....	625,000	652,000	682,000	623,000	603,000	550,000	341,000	277,000	516,000
Germany*	.....	20,000,000	18,300,000	15,703,000	15,058,000	12,637,000	8,602,000	5,183,000	3,870,000	13,187,000
Austria	.....	.....	.....	383,000	244,000	190,000	132,000	87,000	93,000	455,000
Czechia	.....	1,000,000	1,215,000	1,648,000	1,122,000	798,000	591,000	491,000	443,000	1,618,000
Poland	.....	1,000,000	952,000	712,000	575,000	388,000	376,000	301,000	196,000	693,000
Hungary	.....	450,000	330,000	359,000	301,000	183,000	138,000	92,000	65,000	362,000
Russia	.....	15,000,000	14,479,000	14,288,000	14,088,000	12,411,000	10,273,000	7,085,000	6,101,000	4,253,000
Japan†	.....	3,250,000	3,000,000	2,758,000	2,823,000	2,739,000	2,400,000	2,019,000	1,525,000	1,491,000
India	.....	1,800,000	1,634,000	1,629,000	1,543,000	1,466,000	1,331,000	1,065,000	914,000	1,343,000
Australia	.....	1,100,000	1,072,000	914,000	783,000	698,000	487,000	336,000	190,000	420,000
Saar‡	.....	.....	.....	.....	.....	.....	1,797,000	1,567,000	1,327,000	2,071,000
Miscellaneous ...	.....	1,200,000	1,150,000	1,200,000	1,000,000	800,000	700,000	600,000	700,000	750,000
World total.....	.....	100,418,000	80,728,000	101,853,000	89,895,000	72,918,000	61,733,000	48,533,000	39,075,000	97,073,000

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.

Iron, Steel Exports and Imports of Principal Countries

Gross tons—Scrap eliminated

	EXPORTS					IMPORTS				
	1940*	1939*	1938	1937	1936	1940	1939	1938	1937	1936
United States	8,000,000	2,499,220	2,149,000	3,472,000	1,233,000	58,000	285,669	240,000	452,000	528,000
Great Britain	.....	.....	1,918,000	2,576,000	2,203,000	.....	.....	1,341,000	2,039,000	1,483,000
Germany	.....	.....	2,784,000	3,604,000	3,550,000	.....	.....	867,000	532,000	508,000
France	.....	.....	2,002,000	2,133,000	1,575,000	.....	.....	92,000	170,000	173,000
Belgium & Luxemburg....	.....	.....	2,503,000	3,947,000	3,190,000	.....	.....	215,000	428,000	423,000
Total	.....	.....	11,356,000	15,732,000	11,751,000	.....	.....	2,755,000	3,621,000	3,115,000

*Production figures for 1940 and export, import figures for 1939 and 1940, other than Western Hemisphere countries, not available due to war.

countries and protecting the remaining free countries in the Western Hemisphere.

At the beginning of this third period of the war, the relative resources in steel of Great Britain and of the new allies, Germany and Italy, are shown in the third column of Table II, which gives estimates of actual production in 1939 and the estimated capacity of production.

It can be assumed that by the end of the summer of 1940, individual British, German and Italian steelworks were operating very near to capacity, the total output of each country being restricted, in some degree, by actual warfare and destruction. Obviously, neither of the opposing sides discloses its losses. It is known, however, that considerable damage was done to the Krupp works at Essen, and to other iron and steel plants at Dusseldorf, Duisburg and other localities in the Ruhr.

It is impossible to know what percentage of the output controlled by Germany has thus been canceled out, but it is highly probable that, making allowance for that factor, Germany has sufficient plant to draw upon to meet her requirements of raw steel. It is quite apparent that the policy of the combatants is to strike at the places where the finished products are made, more than at the source of production of the materials of which these products are made up. More money and labor thus goes to waste, and more time is needed to replace a product that was ready immediately to play its part in the war.

Little Damage to British Works

As regards British steelworks, it is a fact that by the end of 1940, any damage done was negligible, and the restriction of output caused by interruption by air raids was not sufficient to paralyze production or even reduce it to a critical level. However, even if producing at full rate, the British steel output was not sufficient to meet war time requirements, and considerable tonnages had to be obtained from outside sources. Britain went through an anxious time when Continental sources dried up, but contracts were immediately placed with American works, those contracts placed by the French purchasing commission were transferred to Great Britain, and by August steel and scrap were coming, in growing quantities, from the United States, Canada and Australia. By the fall, India also contributed a fair share of pig iron. Thus, at the end of the year, British anxieties as regards steel supplies were dispersed, thanks to her control of the seas and to the assistance given by American steelworks.

With regard to the raw materials necessary for the production of steel, Britain's position at the end of 1940 was satisfactory. She never depended on others for coal and coke, and the difficulties in regard to iron ore supplies were overcome, thanks to the considerable impetus given to home production and to the resumption of shipments from the Mediterranean, mainly from Spain. High grade Swedish ores, however, were no more available, a net loss of well over one million tons a year. The fact remains that by the end of the year Britain was able actually to build up stocks, not only of ore but also of scrap. Thanks to her empire resources, Britain also had at her disposal the necessary tonnages of alloying metals necessary for the production of special steels.

Germany is not so well placed in regard to supplies of alloying elements. Her iron ore situation at the end of the year was relieved by her re-captured control of the ore fields of Lorraine, which was her main source of supply before the first World war, and whence she imported about 5 million tons annually just before this war. Little is known about the rate of production in countries under German military occupation. There is no doubt, however, that following upon the necessary repairs and reorganization period due to war activities, the output of steel of those countries will be at Germany's beck and call. Italy needs all her own resources to sustain her own share in the Axis war. The French Vichy government was reported, in November, to have dissolved the Comite des Forges and to have replaced this organization, which was composed of steelworks owners, by committees presumably appointed by the government, thus weakening the position of private ownership.

Thus, as we enter 1941, we see that on both sides the steel resources necessary to wage a modern war are available to the combatants. Britain's position is made more difficult by the fact that she depends, to some extent, on imports which must cross the waters, but her mastery of the seas and the willingness of those countries that furnish her with supplies relieves her anxiety in that direction. Should peace bless the world some time in the course of this new year, the capacity of steel production of Europe as a whole would still be greater than it was in 1939.

■ Synthetic oil to power some units of Germany's military machine is stored in steel containers. The Leuna synthetic oil plants, greatest in Germany, have been raided repeatedly by English bombers. NEA photo

European Domestic, Export Prices, 1940

At Works or Furnace

British Domestic Prices

In Pounds Sterling, per Gross Ton

	Jan. £ s d	Feb. £ s d	March £ s d	April £ s d	May £ s d	June £ s d	July £ s d	Aug. £ s d	Sept. £ s d	Oct. £ s d	Nov. £ s d	Dec. £ s d
Foundry pig iron, silicon 2.50-3.00	5- 8-0	5-11-0	5-11-0	5-11-0	5-11-0	5-11-0	6- 0-0	6- 0-0	6- 0-0	6- 0-0	6- 8-0	6- 8-0
Basic pig iron	5- 1-6	5- 4-6	5- 4-6	5- 4-6	5- 4-6	5- 4-6	5-13-0	5-13-0	5-13-0	5-13-0	6- 0-6	6- 0-6
Furnace coke (a)	1- 9-2	1-11-8	1-11-8	1-11-8	1-11-8	1-11-8	1-12-6	1-13-6	1-13-5	1-13-5	.....	.....
Billets	8- 7-6	9- 7-6	9- 7-6	9- 7-6	9- 7-6	9 -7-6	10-10-0	10-10-0	10-10-0	10-10-0	12- 5-0	12- 5-0
Standard rails	10- 3-0	11- 3-0	11- 3-0	11- 3-0	11- 3-0	11- 3-0	12-15-6	12-15-6	12-15-6	12-15-6	14-10-6	14-10-6
Merchant bars	12-16-0	14- 0-0	14- 0-0	14- 0-0	14- 0-0	14- 0-0	15- 8-6	15- 8-6	15- 8-6	15- 8-6	17-12-0	17-12-0
Shapes	11- 8-0	12- 8-0	12- 8-0	12- 8-0	12- 8-0	12- 8-0	13-13-0	13-13-0	13-13-0	13-13-0	15- 8-0	15- 8-0
Plates, ship	11-10-6	12-10-6	12-10-6	12-10-6	12-10-6	12-10-6	14- 3-0	14- 3-0	14- 3-0	14- 3-0	16- 3-0	16- 3-0
Sheets, black, 24 gage	16- 2-6	17-10-0	17-10-0	17-10-0	17-10-0	17-10-0	19- 7-6	19- 7-6	19- 7-6	19- 7-6	22-15-0	22-15-0
Sheets, galvanized, 24 gage, corrugated	18-12-6	20- 0-0	20- 0-0	20-16-3	20-16-3	20-16-3	22-12-6	22-12-6	22-12-6	22-12-6	26- 2-6	26- 2-6
Wire, mild drawn	18- 0-0	19-10-0	19-10-0	19-10-0	19-10-0	19-10-0	21- 5-0	21- 5-0	21- 5-0	21- 5-0	23-15-0	23-15-0
Hoops and bands	13-11-0	14-15-0	14-15-0	14-15-0	14-15-0	14-15-0	16- 3-6	16- 3-6	16- 3-6	16- 3-6	18 -7-0	18- 7-0

(a) f.o.t. at ovens—A rebate of 5s 0d per ton on pig iron, and 15s 0d per ton on bars, shapes, plates and hoops is granted to users on certain conditions.

French Domestic Prices

In French Francs, Per Metric Ton

	Jan.	Feb.	March	April	May	June
Foundry pig iron, silicon 2.50-3.00	788	788	788	788	788	788
Furnace coke	225	225	225	225	225	225
Billets	1163	1163	1163	1163	1335	1335
Standard rails	1588	1588	1588	1588	1715	1715
Merchant bars	1454	1454	1454	1454	1530	1530
Shapes	1414	1414	1414	1414	1487	1487
Plates, 5 millimeters	1848	1848	1848	1848	1951	1951
Sheets, black, 2 mm.; Belgian 2-3 mm.	2193	2193	2193	2193	2295	2295
Sheets, galv., 0.6 mm, corr.; Belgian 0.5 mm.	3438	3480	3499	3502	3589	3589
Plain wire	2250	2340	2340	2340	2340	2340
Hoops and bands	1632	1632	1632	1632	1713	1713

Belgian Domestic Prices

In Belgian Francs, Per Metric Ton

	Jan.	Feb.	March	April	May
Foundry pig iron, silicon 2.50-3.00	850	890	935	950	950
Furnace coke	310	310	330	330	335
Billets	1285	1225	1225	1225	1220
Standard rails	....	....	....	....	....
Merchant bars	1375	1375	1375	1375	1375
Shapes	1375	1375	1375	1375	1375
Plates, 5 millimeters	1610	1610	1610	1610	1610
Sheets, black, 2 mm.; Belgian 2-3 mm.	1900	1900	1900	1900	1900
Sheets, galv., 0.6 mm, corr.; Belgian 0.5 mm.	4200	4200	4200	4200	4200
Plain wire	2000	2000	2000	2000	2000
Hoops and bands	....	....	....	....	....

British Export Prices

In Pounds Sterling, Per Gross Ton, F.O.B. Ports of Shipment

	Jan. £ s d	Feb. £ s d	March £ s d	April £ s d	May £ s d	June £ s d	July £ s d	Aug. £ s d	Sept. £ s d	Oct. £ s d	Nov. £ s d	Dec. £ s d
PIG IRON												
Foundry, No. 3, Middlesbrough	6- 0-0	6- 0-0	6- 0-0	6- 0-0	6- 0-0	6- 0-0	....	....	....	....	....	....
Hematite, East Coast	6- 5-0	6- 5-0	6- 5-0	6- 5-0	6- 5-0	6- 5-0	....	....	....	....	....	....
FINISHED STEEL												
Standard rails	9-10-0	10-10-0	10-10-0	10-10-0	10-10-0	10-10-0	.....	.....	.....	.....	.....	.....
Merchant bars	12- 2-6	13- 2-6	13- 2-6	13- 2-6	13- 2-6	13-10-0	14-15-0	14-15-0	14-15-0	14-15-0	16-10-0	16-10-0
Structural shapes	11- 2-6	12- 2-6	12- 2-6	12- 2-6	12- 2-6	12-10-0	13-15-0	13-15-0	13-15-0	13-15-0	15-10-0	15-10-0
Plates, ship	11- 2-6	12- 2-6	12- 2-6	12- 2-6	12- 2-6	12-10-0	14- 2-6	14- 2-6	14- 2-6	14- 2-6	16- 2-6	16- 2-6
Plates, boiler	12-12-6	13-12-6	13-12-6	13-12-6	13-12-6	14- 0-0	15-12-6	15-12-6	15-12-6	15-12-6	17-12-6	17-12-6
Sheets, black, 24-gage	15-12-6	17- 0-0	17- 0-0	17- 0-0	17- 0-0	17- 0-0	18-17-6	18-17-6	18-17-6	18-17-6	22- 5-0	22- 5-0
Sheets, galvanized, 24 gage, corrugated	18- 2-6	19-10-0	19-10-0	19-18-0	20- 6-3	20- 6-3	22- 2-6	22- 2-6	22- 2-6	22- 2-6	25-12-6	25-12-6
Tin plate, base box, 108 pounds	1-11-9	1-12-6	1-12-0	1-12-0	1-11-0	1-10-6	1- 9-4	1- 7-9	1- 8-0	1- 7-9	1-11-0	1-11-6

Continental Export Prices

In Gold Pounds, Per Gross Ton, F.O.B. Channel or Northern Seaports

	Jan. £ s d	Feb. £ s d	March £ s d	April £ s d	May £ s d	June £ s d	July £ s d	Aug. £ s d	Sept. £ s d	Oct. £ s d	Nov. £ s d	Dec. £ s d
PIG IRON												
Foundry, silicon 2.50-3.00	3-11-3	3-14-3	3-18-0	3-18-0	3-18-0	.....	.....	.....	.....	.....	.....	.....
SEMIFINISHED STEEL												
Billets	3-15-0	3-15-0	3-15-0	3-15-0	3-15-0	.....	.....	.....	.....	.....	.....	.....
Wire rods	7- 3-0	7- 2-0	7- 4-0	6-19-6	7- 3-9	.....	.....	.....	.....	.....	.....	.....
FINISHED STEEL												
Standard rails	5-15-0	5-15-0	5-15-0	5-15-0	5-15-0							
Merchant bars	7-12-0	7- 4-0	7- 5-0	7- 3-0	7- 5-6							
Structural shapes	7-10-0	7- 9-3	7-10-0	7- 7-0	7- 9-0							
Plates	9- 7-6	8-10-0	8-10-0	8-19-0	9- 3-6							
Sheets, black, 24 gage, close annealed	8-16-0	7-18-0	7-18-6	7-17-6	7-17-0							
Sheets, galvanized, 24 gage, corrugated	12- 5-0	11-17-0	11-11-0	10-16-0	10-11-9							
Hoops and bands	7- 7-6	7- 5-0	7- 1-0	7- 1-0	7- 5-0							
Plain wire, base	8- 0-0	8- 2-6	8-10-0	8- 7-9	8- 6-3							
Galvanized wire, base	9-11-3	9-14-6	10- 5-0	10- 0-6	9-17-6							
Wire nails, base	9- 5-0	9- 7-6	9-15-0	9-10-6	9 -7-6							

No continental prices available after German occupation of Belgium and France

British Industry

Government, Labor, Management Pulling Together. Lack of War Preparations Overcome in Recent Months. No Shortage of Skilled Workers; "Blackout" a Problem. Tax Takes Profits; Exports, Imports About Balance.

By J. A. Horton

British Correspondent, STEEL

BIRMINGHAM, ENGLAND

■ THE YEAR 1940 will go down in history as one of the most critical that Britain ever experienced. Probably at no time has she ever been nearer defeat than after the collapse of France in June. From then until November the threat of invasion was very real and had it not been for the incessant hammering of the Royal Air Force bombers at the invasion ports there is no doubt Germany would have risked everything in an attempt to take the "island set in a silver sea."

Preparedness was the word on everybody's lips. Britain had to be ready to meet the invader. Hence the need for equipment of every kind, and the result was an appeal to the steel trade for steel, steel and yet more steel. Furthermore, Britain had lost to the enemy large quantities of supplies which had been shipped to France with the expeditionary force, and which could not be brought back when the force returned from Dunkirk.

The over-running of Belgium and Luxemburg and the collapse of France had far-reaching effects upon the British iron and steel industry. For many years those countries had supplied large quantities of semi-finished material to Britain. Finished material had also been imported to a lesser degree. The cessation of these supplies presented difficulty and caused misgiving at the time, but thanks to steps taken by the iron and steel control and the ministry of supply, fresh sources were tapped, and during the last months of the year rerollers were able to keep production at maximum pitch. Furthermore, there is every reason to believe that continuity of supplies will be maintained.

A large proportion of this material, in the form of billets and sheet bars, has come from America, but some raw material has also been provided by the dominions. Nor are these purchases confined to semi-finished steel. In view of the difficulty of getting special supplies of ore from the Continent and North Africa, supplies, of hematite and low phosphorus pig

■ **Steel bunks like the ones shown here have been installed in English subways and air-raid shelters. Increasing the comfort of the civilian population under almost incessant bombing attacks contributes to the maintenance of British morale. Acme photo**

Organized To Win

iron were bought from other areas and increased quantities are likely to be available soon.

The cost of importing material on such a scale is obviously heavy, but the iron and steel control has a central fund which is used expressly for this purpose, and it is to this fund mainly that the money obtained from higher prices for British steel is allocated.

There were three advances in British steel prices during the year, Feb. 1, July 1, and Nov. 1, and four since the war began, and, with one exception, it was stated that the reason for raising prices was necessity for strengthening the central fund. Only once did the makers receive any benefit. Another reason for dearer steel, quite apart from the central fund, was the increase in railroad rates, which became effective Dec. 1.

Price fluctuations during 1940 are shown in the table on page 311, from which it will be seen that for the full year pig iron prices went up by 18 per cent, billets by 22.5 per cent, and finished products 35 to 40 per cent.

The sheet trade had a busy year. In the earlier months it concentrated on providing material for the building of Anderson shelters which the government distributed free of charge to millions of people throughout the country. Sir John Anderson's name has been perpetuated by these popular shelters which have proved their worth in the severe testing which Britain has had to stand up to since Germany began its air offensive.

The provision of these shelters gave an enormous amount of work to sheet and galvanized sheet makers and the government allocated the steel necessary for the completion of the orders. Anderson shelter contracts, however, were finished before the year came to an end, and while some sheetmakers are still fully engaged on work for the defense departments raw material is more difficult to get because steel is wanted primarily for armament and shell factories, and occasionally sheet works are held up because of a shortage of sheet bars. A big tonnage of these sheet bars comes from America and delays in delivery are inevitable under present conditions.

The tin plate trade has been one of those industries which at first received a fillip from the war, and it is now working at a higher rate than for many years. The export trade, however, suffered a severe setback when France collapsed, when large contracts

■ **Thousands of shell blanks stacked in England, ready to be transported to a munitions factory to be turned into finished projectiles. NEA photo**

had to be canceled. The trade now relies entirely on overseas markets, from which demand was relatively quiet during the latter part of the year. Some centralization of tin plate mills has taken place in South Wales so as to cut out redundancy, and with a growing demand for canned foods, there is now a healthy outlook for the British tin plate trade.

The black-out proved a real problem for many producers of iron and steel. From a health point of view conditions are bad for the workers, particularly during the winter months. Many conferences between employers and operatives were held with a view to improving the atmospheric conditions and all sorts of suggestions were considered. Fans have been installed to remove injurious fumes and roof outlets have been arranged for the same purpose. Manufacturers have gone to great expense to insure that the black-out is effective as they know this is the best safeguard against air raids. As a matter of fact the damage done to iron and steelworks through air raids has been negligible.

Generally speaking, wages are regulated under a sliding scale which follows closely the cost of living as officially declared in the *Ministry of Labour Gazette*. There was a 20 per cent advance in wages at the beginning of the war but shortly afterwards the Midland iron and steel wages board stabilized the scale and instituted a cost-of-living bonus.

Thus if the cost of living is declared to be two points higher Nov. 1, the men receive wages two points higher Dec. 1. Under this system it seems unlikely that the men will ever receive the very high rates which prevailed during and just after the war of 1914-18. The government is keeping a tight hold on commodity prices and this automatically checks the rise in the cost of living.

Work Three Eight-Hour Shifts

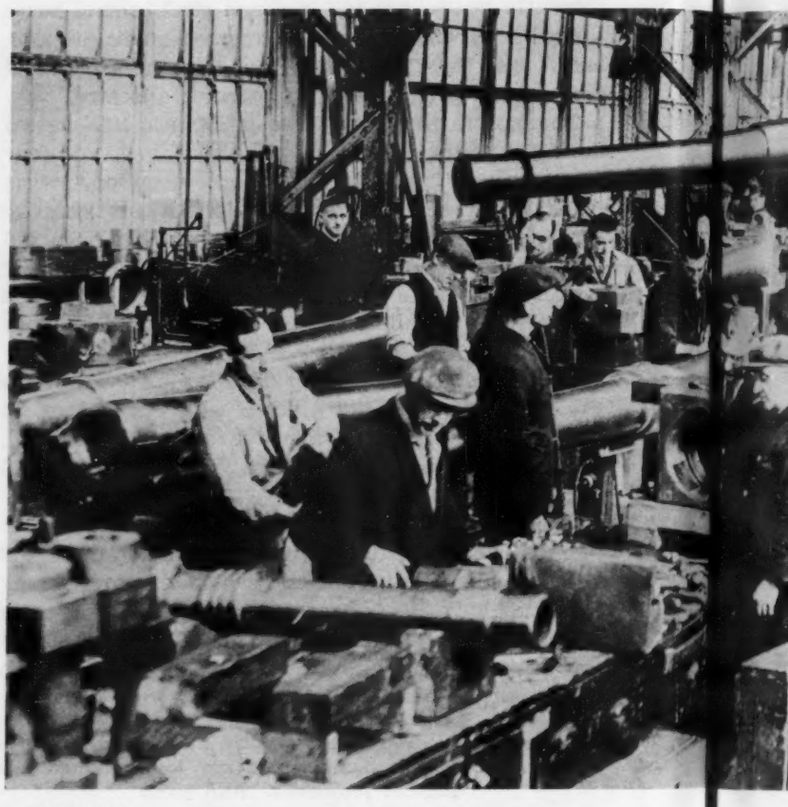
The heavy output which was achieved last year was made possible only by the workers in the industry. For many years employers and employed have tackled their problems jointly and it is their proud boast that there have been few disputes over a long period. An organization exists in which the interests of both sides are represented and this body deals with all matters of wages, hours and conditions of labor.

In the steelworks three eight-hour shifts are being worked throughout the week, but in addition most firms are doing extra shifts at the week-end. The normal time of starting would be 2 o'clock on Sunday afternoon but under present circumstances an extra shift begins Sunday morning at 6.

A six-day week is being worked at the blast furnaces. Every seventh day is a rest day for some of the men. This was an arrangement brought into operation soon after the war started and, of course, necessitated employing a larger number of men, but it has been found to be the best method of maintaining production. Extended working weeks in the steelworks are the subject of arrangements between the men's unions and the managements. Applications have to be made to the union before the extensions are agreed to.

Ernest Bevin, minister of labor and past leader of the powerful transport workers' union, is a man with dynamic personality, a complete understanding of the working man and a deep sense of responsibility. He is putting his whole weight in the task of intensifying production and at the same time improving labor conditions. What advantages he has obtained for the workmen he is determined they will keep. More will be heard of Mr. Bevin in time to come.

The steel melter, who earned something between £10 ($40) and £12 ($48) a week before the war is now getting £14 ($56) to £15 ($60). At the other end of the scale the laborer's wage today is about £3 5s ($13) as compared with £2 2s ($8.40). Most of the men, it is estimated, are getting wages about one-



■ A 4.7-inch gun swings over the heads of workmen in an English plant. British production is at top speed, in an attempt to equal German supplies of armament and munitions. NEA photo

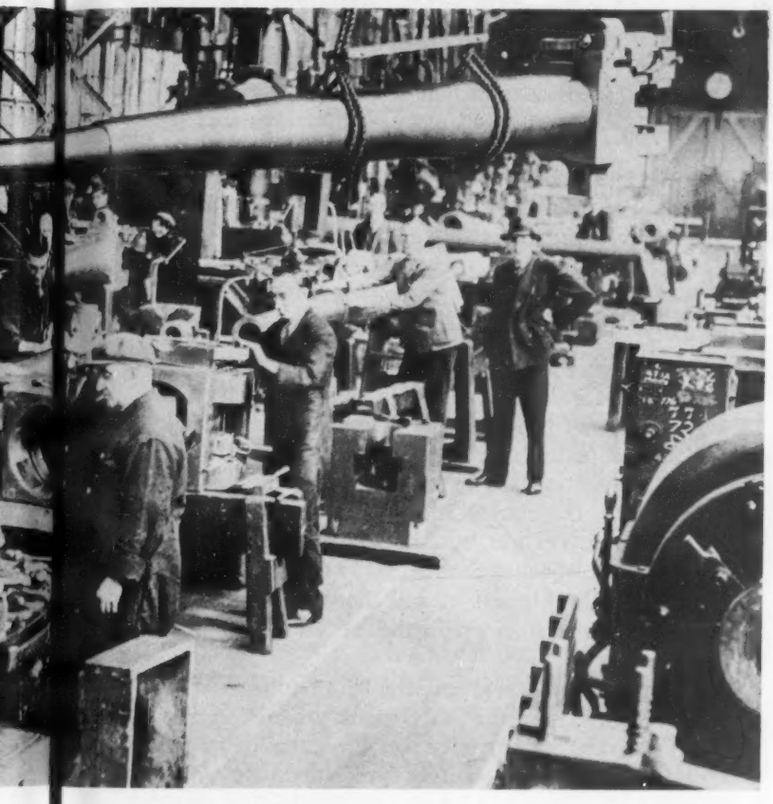
fifth higher than they were just prior to the war, but it should be remembered that the cost of living has gone up also.

No real difficulty has been experienced so far in obtaining skilled men in the steelworks and output has certainly not been impeded in any way from this cause. One reason is that the men are trained in the works and whenever one falls out his place can quickly be filled. In the engineering and machine tool industries the problem of the skilled workman is more acute. Men engaged in the production of iron and steel are exempted from military duties.

When industry is working at top speed to provide its fighting forces with all the material that they need, it is obvious that export business must take a

secondary place. As was to be expected, exports slumped badly upon the outbreak of war, but later in the year there was a steady improvement month by month. Once again, however, the collapse of France upset the calculations of those who were trying to develop export trade, and for a time little material was available for export purposes.

The government has made it clear that larger quantities of material for export will be released as and when opportunity offers. An export drive was initiated early in the year, and with the backing of the government, there was a real quickening of interest in overseas business. British manufacturers were not slow to seize the opportunities for fresh business, especially in areas where German firms formerly held sway.



Export groups were formed for various industries and this scheme has proved very successful since the board of trade and the iron and steel control act jointly in the allocation of steel to the groups for the manufacture of goods for export.

In the nine months ended Sept. 30 the value of iron and steel exports totaled £25,710,048, compared with £26,013,208 in the corresponding period of 1939, and £31,163,974 in the corresponding period of 1938. There is every reason to believe that a fresh progressive movement has set in. A big potential demand is reported in a number of markets and manufacturers are dealing with it as steel becomes available.

The present policy of the board of trade is to release for export only goods that are not essential to the national war effort. Home consumption of nonessential goods is restricted so that these goods can be made available for export without absorbing too large a proportion of labor. Exports are encouraged and directed mainly to markets where payment is made in dollars or in currencies linked with the dollar.

Exports, even of certain essential products, are released to the Dominions and other countries taking part in Britain's war effort, and in order to assist that effort. Thirdly, exports of nonessential goods are released to markets where British manufacturers have a strong foothold and of long standing, or to countries that supply Britain with essential goods. From this it will be seen that only highly finished steel products yielding a good price will be released for export, exception being made for tonnages required to further the war effort of friendly countries and the latter are very limited.

It is, of course, on the import side that the biggest increase has occurred in British trade with other countries. In the first nine months iron and steel purchases from overseas totaled £26,126,514, an increase over the corresponding period of 1939 of £13,711,336.

Scrap Demand Increases

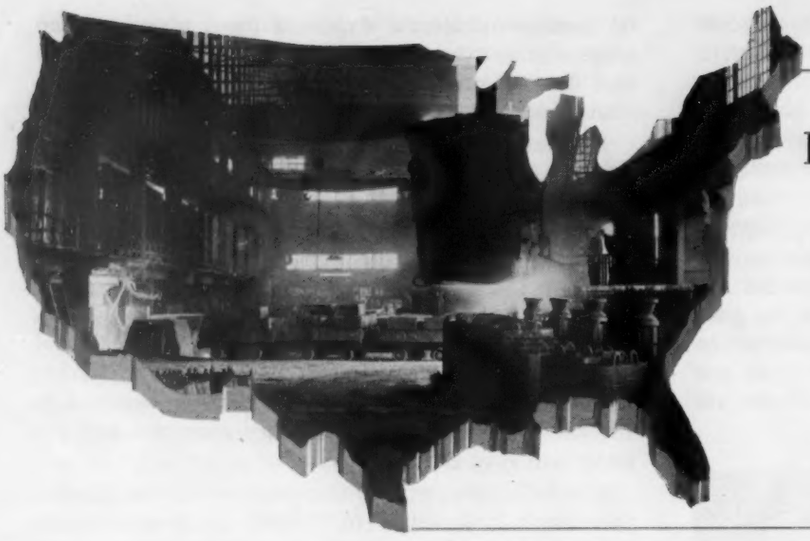
An interesting feature of the home market was the growth of the demand for scrap. Remarkable changes took place over a comparatively short period, for in the first half of the year there was an outcry for scrap to feed iron and steel furnaces, and in every district sufficient material was not available.

The government stepped in and organized a scrap collection campaign, not only urging dealers to find as much as possible, but making it incumbent upon local authorities in the various towns and cities to salvage every bit of metal from the dustbins. The success of this campaign, combined with heavy purchases from America, brought about a considerable change in the last quarter. Supplies became plentiful and, indeed, some users found it necessary to suspend delivery as they were getting much more than they wanted.

The output of pig iron attained a high level during the year. The market is controlled by a licensing system and a tight hand is kept upon supplies, every care being taken that pig iron shall be used only for essential purposes. In the early months of the war the building and allied trades suffered a severe slump and consequently many makers of light castings who had concentrated on the provision of articles for the domestic trade found themselves in difficulties.

Against this is the fact that many furnaces which were producing foundry iron prior to the war have since been engaged on supplying basic material to fulfill the ever growing needs of the steel industry. Chief demand for pig iron comes mainly from heavy engineering foundries. The price of pig iron has gradually risen since the beginning of the war, and to take only one example, ordinary Derbyshire iron costing £5 1s ($20.20) per ton in September, 1939, now costs £6 10s ($26).

The British iron and steel industry is entering 1941 with its works in full swing and organized to take its whole share in the war effort of which it is such an essential part.



DOMESTIC MARKET SUMMARY

Ingot production establishes new record in 1940. National defense requirements, exports and active normal domestic demand necessitate moderate expansion of facilities. Prospects for 1941 are for peak operations, if war continues. Priorities may become necessary. Prices during past year remarkably stable.

■ ALL-TIME record steel ingot production in 1940 caused little surprise in view of the immensity of the preparedness program and demand from abroad. Production of 66,344,166 net tons (with December estimated) compares with the previous high of 61,432,485 tons in 1929. Such supremacy over 1929 was possible through the increase in capacity of 9,337,913 net tons since that year, capacity for open-hearth and bessemer steel, as of Dec. 31, 1939, having been 79,353,467 net tons.

Considering the world turmoil and the drain upon American steel supplies at home and abroad, affairs in the steel industry moved with remarkable smoothness. No general changes in steel prices occurred throughout the year; no famine in steel resulted despite several threatened bottlenecks; and virtually no labor discord.

Besides supplying an almost unprecedented demand at home the United States was a main support of France and Britain, later Britain only, as well as other parts of the world, many of which had been cut off from usual sources of supply. Exports of finished steel reached 20 per cent of total production.

Full operations through 1941, provided the war continues at present intensity, is forecast by leaders in the industry.

The character of demand may shift from steel for building and equipping new plants to steel to be processed in those plants. Should the present war cease through collapse of Britain, the American defense program would probably proceed more energetically.

Further minor expansion of steelmaking facilities will probably take place throughout 1941, even though capacity is considered sufficient by industry spokesmen. This expansion probably will take the form of rounding out and more completely integrating facilities. Following the banner year of 1929, 4,272,397 net tons, or 6 per cent, was added to ingot capacity; in 1931 1,523,110 net tons or 2 per cent more was added.

In 1929 production was for some time over 100 per cent of rated capacity and in that respect superior to 1940. From the standpoint of actual tonnage produced, however, certain months of 1940 made new records. Thus steel ingot production in October, 6,461,898 tons, was the highest in any month for all time. The industry was then operating at an average of 96.10 per cent.

During the first several months of 1940 production declined steadily. At the start ingot production was at 86½ per cent of capacity, or 4 points below the pre-holiday period immediately preceding. By April 1 the rate had sagged to 61 per cent; by the first week in May it increased to 63 per cent when the first good recovery in buying in 1940 was experienced. The rate increased almost continuously to virtually the end of the year. By late November, 97 per cent was reached.

Recessions in production early in the year were due to large inventories carried over from 1939, built up in the fourth quarter, 1939, when outbreak of the war recalled experiences during the World war.

Since, in the present war, machines predominate as never before, the demand for steel to make these machines was far above the needs of the World war. During the early part of 1940, United States steelmakers were exporting 10 to 15 per cent of their production; during the second half the average was nearer 20 per cent, whereas in normal peace time 5 per cent rules. The collapse of important foreign steel outlets such as Norway, Holland, Belgium, France, Italy and others was nullified by increasing quantities of steel bought here by Great Britain. By August steel exports had reached an all-time high of 1,046,084 gross tons, ex-

clusive of scrap, with Britain taking 60 to 65 per cent.

Superimposed on the increasing export demand was our own national defense program which reached the stage of placing large orders during the second half. Large tonnages of structurals and reinforcing bars were placed for building new plants and additions for manufacturing defense items, for constructing cantonments, aircraft plants and hangars. Unusual orders embraced shell steel, armor plate for ships and tanks, strip steel for helmets. It was estimated that 150,000 kegs of nails would be needed for building cantonments. Barbed wire was bought for the army; tableware for the army and navy. In early September it was announced that an immediate shipbuilding program for the navy, comprising 7 battleships, 8 aircraft carriers, 27 cruisers, 115 destroyers and 43 submarines, would take 725,000 tons of steel, including armor plate and heavy forgings, for delivery over several years.

On much of the armament manufacture the country had to start from scratch, as most World war steel armament equipment had been scrapped or was lamentably out of date. Thus 1940 in the steel trade was turbulent as the nation tried to whip itself onto a war footing in a short time. Fortunately capacity in United States for producing basic steel items has at all times been regarded as adequate.

So far steel conditions have proved much superior to World war days as regards prices and supplies. As 1940 closed pig iron was $23 per ton as against $33 to $55 in the 1914-1918 period. Deliveries in certain items during the former war could not be promised in less than a year as against a four months' maximum today. Then ingot capacity was about 50,000,000 net tons per year as against around 80,000,000 tons today.

The year was characterized by the especially good demand for heavy steel as against light steel, which is natural for a nation arming, since heavy steel goes into manufacture of ships, tanks, cannon and shells, as well as plant building for creating those munitions. A flurry of light steel demand was apparent in early April when prices were cut $4 per ton, as consumers realized bargain prices might be short-lived. Consumers booked so heavily at that time that revived demand was not apparent until fall.

Steel Capacity To Be Increased

Some light steel, of course, goes into defense, as galvanized sheets for roofs and perhaps siding for small plants; tin plate for soldiers' canned food; sheets for military cooking equipment; nails for building cantonments and fencing for munitions works.

Considerable discussion late in the summer revolved around estimates as to how much of our steel would go into defense work and whether the United States would prove self-sufficient in steel. The American Iron and Steel institute estimated defense needs would require only 7,000,000 to 8,000,000 tons annually. It was also concluded that steelmaking equipment was sufficient in the early fall, but by mid-December several steelmakers announced plans for increasing capacity of coke and pig iron, and enlarging open hearths, among them being the Tennessee Coal, Iron & Railroad Co., Bethlehem Steel Co. and National Steel Corp.

Brisk demand for steel in the last quarter of 1939 had caused repairing and remodeling of much equipment. Thus many beehive ovens were restored to workability. In second half many predictions of impending bottlenecks were made, mentioning coke, pig iron, scrap, armor plate and forging departments and heat-treating units. But up to the close of the year no great embarrassment had occurred. There was a rush to build new electric steel units and many bessemer converters were being made ready to start again. The first month that output of steel ingots was a new high for all time, October, when the industry averaged 96.1 per cent of capacity, bessemer production was at 80.13 per cent, indicating further room for improvement there.

General Steel Priorities Not Invoked

Another uppermost question during second half was whether Washington would install a strict system of priorities by which civilian uses would be relegated to any surplus from defense needs. Steelmakers claimed that they could handle the situation by themselves and consumers co-operated in working out voluntary rationing. Occasionally a preferential slip was issued by Washington and presented to steelmakers, but no general priorities on steel were put in motion. Though the supply situation was tense by the end of the year, the matter was still well in hand, it being more a problem of proper distribution than sufficiency of supply.

In some cases steelmakers bartered raw materials among one another, such as coke for pig iron. It was being predicted late in the year that raw materials might be shipped far afield, particularly among plants of the same company, the semifinished items to be processed where finishing capacity was less congested.

Prices were remarkably lacking in important changes during the year. Early in April Carnegie-Illinois Steel Corp. recognized weakness in hot-rolled sheets and strips by reducing $4 per ton; shortly thereafter enameling sheets and cold-rolled sheets were reduced the same; a few weeks later it came to light that galvanized sheets had been marked down. New prices were $5 to $7 per ton below levels of a year before. As usual, buying by automobile makers had broken the market.

Thereupon STEEL's composite price on finished steel dropped 80 cents to $55.30, comparing with $56.50 a year earlier. June 30 was set as the deadline for shipments of this bargain material, but actually the final date was postponed until Sept. 30, with probability that some tonnage extended even farther.

Near the end of April mills announced withdrawal of all previous cuts on flat-rolled steel and reaffirmed prices on all other steel products for third quarter about a month earlier than usual.

At the middle of March concrete bars were reduced officially $3 per ton and rail steel merchant bars were cut $2, thus eliminating most of the $3 rise of the previous September when prices had been put on a parity with billet bars. However by mid-July concrete bars were advanced $5 and rail steel bars were marked

(*Please turn to Page* 326)

Monthly Price Averages for Twelve Years

Price Averages for Years Prior to 1929 may be found in STEEL for January 7, 1935

ORES AND ALLOYS

Per Gross Ton

Iron Ore Prices at Date of Buying Movement, Delivered Lower Lake Ports

Season	Date buying movement	Old range Bessemer Ton	Old range Bessemer Cents per unit	Old range Nonbessemer Ton	Old range Nonbessemer Cents per unit	Mesabi Bessemer Ton	Mesabi Bessemer Cents per unit	Mesabi Nonbessemer Ton	Mesabi Nonbessemer Cents per unit	Iron prices, Valley Bessemer	Iron prices, Valley No. 2 Foundry
1940	Apr. 17, 1940*	$4.75	9.223	$4.60	8.932	$4.60	8.932	$4.45	8.641	$23.50	$23.00
1940	Jan. 2, 1940	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	23.50	23.00
1939	May 3, 1939	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	21.50	21.00
1938	May 23, 1938	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1937	Mar. 12, 1937	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1936	Apr. 3, 1936	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	20.00	19.50
1935	May 4, 1935	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1934	May 19, 1934	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1933	June 12, 1933	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	16.00	15.50
1932	June 3, 1932	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	14.50	14.50
1931	Apr. 15, 1931	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	17.00	17.00
1930	Apr. 1, 1930	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1929	Mar. 22, 1929	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	18.50	18.00

*Price reduced.

Manganese Ore

Dollars Per Gross Ton, Duty Paid, Northern Atlantic Ports, on Basis of 50 Per Cent Ore

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$30.10	$30.10	$30.10	$30.10	$30.10	$33.60	$34.10	$35.60	$34.35	$32.85	$32.85	$32.85
1939	20.85	20.85	20.35	20.10	20.10	20.10	20.10	20.10	Nom.	29.32	30.52	30.66
1938	28.10	28.10	28.10	28.10	28.10	28.10	25.60	25.60	25.60	22.60	21.10	21.60
1937	21.10	22.60	22.85	27.60	27.60	27.85	31.85	31.85	31.85	30.60	28.60	28.10
1936*	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	19.10	19.10	20.60
1935	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70
1934	21.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	23.20	23.70	23.70	23.70
1933	19.95	19.95	19.95	19.95	19.95	20.20	20.45	21.45	21.45	21.70	21.70	21.70
1932	22.70	22.70	22.70	22.70	21.70	21.70	21.70	21.70	21.20	21.20	21.20	20.70
1931	24.20	24.20	23.70	23.70	23.70	23.70	23.70	23.70	23.70	22.70	22.70	22.70
1930	29.95	24.70	24.70	24.70	24.70	24.70	24.70	24.20	24.20	24.20	24.20	24.20
1929	27.70	27.70	27.70	27.70	27.70	27.70	26.70	26.70	26.70	25.70	25.70	25.70

*Effective Jan. 1, duty ½c per pound metallic content; $5.60 gross ton on 50 per cent ore.

Bessemer Ferrosilicon, 10 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00	$33.00
1939	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	31.00	32.00	32.00	33.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	29.00	29.00	29.00	30.00	30.00	30.00
1937	29.00	29.00	31.80	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	29.00
1935	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1934	27.25	27.25	27.25	27.25	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1933	20.50	20.50	20.50	20.50	20.50	20.75	22.40	24.65	27.00	27.75	27.75	27.75
1932	23.00	22.00	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
1931	25.00	25.00	25.00	25.00	25.00	25.00	25.00	24.00	23.00	23.00	23.00	23.00
1930	30.00	30.00	30.00	30.00	30.00	29.50	29.00	29.00	25.00	25.00	25.00	25.00
1929	31.00	31.00	31.00	31.00	31.00	31.00	31.00	30.20	30.00	30.00	30.00	30.00

Ferrosilicon, 50 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$69.50	$69.50	$69.50	$69.50	$69.50	$70.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50
1939	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1938	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1937	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1936	77.50	77.50	77.50	77.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1935	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1934	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1933	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1932	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	76.30
1931	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	77.50
1930	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50
1929	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50

Spiegeleisen, 20 Per Cent

At Producers' Furnaces

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$32.00	$32.00	$32.00	$32.00	$32.00	$34.40	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1939	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	32.00	32.00	32.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	28.00	28.00	28.00	28.00	28.00	28.00
1937	26.00	26.00	28.00	30.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1935	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1934	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1933	24.00	24.00	24.00	24.00	24.00	24.00	27.00	27.00	27.00	27.00	27.00	27.00
1932	27.00	27.00	27.00	27.00	27.00	26.50	25.00	25.00	25.00	25.00	24.25	24.00
1931	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	27.00
1930	34.00	34.00	34.00	34.00	34.00	34.00	33.00	33.00	33.00	33.00	33.00	30.00
1929	34.00	34.00	34.00	34.00	34.00	34.00	34.00	33.20	33.50	34.00	34.00	34.00

Ferromanganese, 80 Per Cent, del. Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$105.33	$105.33	$105.33	$105.33	$105.33	$105.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33
1939	91.58	85.33	85.33	85.33	85.33	85.33	85.33	85.33	95.33	105.33	105.33	105.33
1938	107.49	107.49	107.49	107.49	107.77	107.77	97.77	97.77	97.77	97.77	97.83	97.83
1937	84.79	84.79	92.29	99.79	107.29	107.29	107.29	107.29	107.29	107.29	107.39	107.49
1936*	90.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	82.65
1935	89.79	89.79	89.79	89.85	90.13	90.13	90.13	90.13	90.13	90.13	90.13	90.13
1934	90.24	90.24	90.24	90.24	90.24	90.00	89.79	89.79	89.79	89.79	89.79	89.79
1933	73.24	73.24	73.24	73.24	73.24	73.24	84.44	87.24	87.24	87.24	87.24	87.24
1932	79.85	80.24	80.24	80.24	80.24	74.99	73.24	73.24	73.24	73.24	73.24	73.24
1931	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	79.79
1930	104.79	103.79	103.79	103.79	103.79	103.79	103.79	103.79	103.79	103.79	103.79	93.25
1929	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	104.79

*Duty of 1 cent per pound contained manganese became effective on ferromanganese Jan. 1, 1936.

PIG IRON

Per Gross Ton

Basic, Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$22.50	$23.00
1939	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	21.50	22.50	22.50	22.50
1938	23.50	23.50	23.50	23.50	23.50	23.50	19.50	19.50	19.50	20.50	20.50	20.50
1937	20.50	20.50	23.10	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1936	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.25	20.00
1935	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	19.00	19.00
1934	17.00	17.00	17.00	17.60	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
1933	14.00	14.00	14.00	14.00	14.40	15.00	15.60	16.00	17.00	17.00	17.00	17.00
1932	15.00	15.00	15.00	15.00	15.00	14.50	14.00	14.00	14.00	14.00	14.00	14.00
1931	17.00	16.75	16.75	17.00	17.00	17.00	17.00	17.00	17.00	16.60	15.00	15.00
1930	18.50	18.50	18.50	18.50	18.50	18.50	18.25	18.00	17.75	17.00	17.00	17.00
1929	17.50	17.50	17.60	18.00	18.30	18.50	18.50	18.50	18.50	18.50	18.50	18.50

Basic, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.34	$24.84
1939	22.34	22.34	22.34	22.34	22.34	22.34	22.34	22.34	23.54	24.34	24.34	24.34
1938	25.34	25.34	25.34	25.34	25.34	24.69	21.34	21.34	21.34	22.34	22.34	22.34
1937	22.26	22.51	24.76	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26
1936	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	21.06	21.81
1935	19.76	19.76	19.76	19.76	19.81	19.81	19.81	19.81	19.81	19.81	20.81	20.81
1934	18.76	18.76	18.76	19.51	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76
1933	13.50	13.50	13.50	14.19	15.99	18.19	16.79	17.20	17.76	17.76	17.76	18.76
1932	16.00	15.75	15.75	15.00	15.00	14.50	14.35	13.90	13.75	13.60	13.50	13.50
1931	17.25	17.25	17.25	17.25	17.00	17.00	16.75	16.75	16.00	16.00	16.00	16.00
1930	19.20	19.00	18.80	18.76	18.75	18.75	18.00	18.00	17.87	17.50	17.50	17.50
1929	20.15	20.50	20.25	20.25	20.50	20.25	19.85	19.85	19.85	19.75	19.75	19.75

No. 2 Foundry, f.o.b. Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.20	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.20	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.75	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	15.50	15.50	15.50	15.50	15.90	16.00	16.75	17.00	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.00	15.60	16.00	15.50	15.50	15.50	15.50	15.50	15.50
1931	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.20	17.00	16.60
1930	20.00	20.00	19.50	19.40	19.00	18.40	17.90	17.50	17.50	17.50	17.50	17.50
1929	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

No. 2X Foundry, delivered Philadelphia

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.21	$25.71
1939	23.21	23.21	23.21	23.21	23.21	23.21	23.21	23.21	24.41	25.21	25.21	25.21
1938	26.21	26.21	26.21	26.21	26.21	26.21	22.21	22.21	22.21	23.21	23.21	23.21
1937	23.14	23.39	25.64	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14
1936	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.93	22.68
1935	20.63	20.63	20.63	20.63	20.68	20.68	20.68	20.68	20.68	20.68	21.68	21.68
1934	19.63	19.63	19.63	20.38	20.63	20.63	20.63	20.63	20.63	20.63	20.63	20.63
1933	13.76	13.76	13.76	14.51	15.91	16.76	17.28	17.88	18.63	18.63	18.63	19.63
1932	15.76	15.76	15.76	15.66	15.13	14.76	14.76	14.51	14.26	14.16	13.95	13.88
1931	18.26	18.26	18.26	18.26	17.76	17.76	17.76	17.51	17.01	16.01	16.01	15.76
1930	21.56	21.26	20.76	20.76	20.26	20.26	20.26	19.76	19.76	19.26	19.13	18.26
1929	22.26	22.01	22.26	22.26	22.76	22.76	22.76	22.26	22.26	22.26	22.26	21.76

No. 2X Foundry, f.o.b. Buffalo

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.50	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.25	23.50	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	19.75
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	16.50	16.50	16.50	16.50	16.50	16.50	17.10	17.75	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.50	16.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
1931	18.00	18.00	18.00	18.00	17.60	19.00	19.00	18.75	19.00	18.40	18.00	18.00
1930	19.40	19.00	19.00	19.00	19.00	16.50	16.50	16.50	16.50	16.50	16.50	16.50
1929	19.00	19.00	19.25	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Southern No. 2, f.o.b. Birmingham

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.38	$19.88
1939	17.38	17.38	17.38	17.38	17.38	17.38	17.38	17.38	18.58	19.38	19.38	19.38
1938	20.38	20.38	20.38	20.38	20.38	20.38	16.38	16.38	16.38	17.38	17.38	17.38
1937	17.38	17.63	19.88	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1936	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.84	15.75
1935	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.75	15.50
1934	13.50	13.50	13.50	14.25	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1933	11.00	11.00	11.00	11.40	12.00	12.00	12.60	13.00	13.50	13.50	13.50	13.50
1932	12.00	11.20	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
1931	14.00	13.00	13.00	13.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
1930	14.70	15.00	14.50	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
1929	16.50	16.50	16.50	15.50	15.50	15.25	14.00	14.00	14.00	14.00	14.00	14.00

Malleable, f.o.b. Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.00	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.60	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.10	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	14.50	14.50	14.50	14.50	14.90	15.50	16.10	16.50	17.50	17.50	17.50	17.50
1932	16.00	15.50	15.50	15.50	15.00	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1931	17.50	17.25	17.00	17.00	17.00	17.00	17.00	17.00	17.00	16.90	16.50	16.00
1930	19.00	19.00	19.00	19.00	19.00	19.00	18.75	18.50	18.35	17.80	17.50	17.50
1929	18.00	18.00	18.10	18.50	18.80	19.00	19.00	19.00	19.00	19.00	19.00	19.00

Standard Low Phosphorus, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$29.74	$30.24
1939	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	28.94	29.74	29.74	29.74
1938	29.63	29.63	29.63	29.70	29.74	29.74	26.74	26.74	26.74	27.74	27.74	27.74
1937	26.63	26.88	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63
1936	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.38	26.13
1935	24.63	24.63	24.63	24.63	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
1934	24.13	24.13	24.13	24.13	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63
1933	20.75	20.50	20.50	20.50	21.68	22.00	22.80	23.50	23.13	23.13	23.13	24.13
1932	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76
1931	24.76	24.76	24.76	24.76	24.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76
1930	24.76	24.76	24.76	24.76	24.76	24.26	24.26	24.26	24.76	24.76	24.76	24.76
1929	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.76	24.76	24.76	24.76

Lake Superior Charcoal, delivered Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.34	$30.84
1939	28.34	28.34	28.34	28.34	28.34	28.34	28.34	29.54	30.34	30.34	30.34	30.34
1938	30.24	30.24	30.24	30.34	30.34	30.34	28.34	28.34	28.34	28.34	28.34	28.34
1937	26.54	26.54	28.95	30.04	30.04	30.04	30.04	30.04	30.04	30.04	30.14	30.24
1936	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.50	26.25
1935	24.04	24.04	24.04	24.15	24.25	24.25	24.25	24.25	24.25	24.90	25.25	25.25
1934	23.54	23.54	23.54	23.66	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04
1933	23.04	23.04	23.04	23.06	23.04	23.04	23.04	23.04	23.54	23.54	23.54	23.54
1932	22.29	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	24.04	23.04
1931	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	25.54	25.04	25.04	20.79
1930	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04
1929	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04

SEMIFINISHED STEEL

Per Gross Ton f. o. b.

Open-Hearth and Bessemer Billets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	29.00	29.00	28.40	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	28.50	29.00
1934	26.00	26.00	26.00	27.80	29.00	29.00	27.40	27.00	27.00	27.00	27.00	27.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	27.00	27.00	27.00	27.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1931	30.00	30.00	30.00	30.00	30.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
1930	33.80	33.00	33.00	33.00	32.20	31.25	31.00	31.00	31.00	31.00	31.00	30.50
1929	33.00	34.25	34.00	34.50	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Open-Hearth and Bessemer Sheet Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	30.00	30.00	28.50	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	29.50	30.00
1934	26.00	26.00	26.00	28.40	30.00	30.00	28.40	28.00	28.00	28.00	28.00	28.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1931	30.00	30.00	30.00	30.00	29.75	29.00	29.00	29.00	29.00	29.00	29.00	29.00
1930	33.80	33.00	33.00	33.00	32.20	31.25	31.00	31.00	31.00	31.00	31.00	30.50
1929	34.00	33.25	35.00	35.25	26.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Wire Rods, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940*	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00
1939	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
1938	47.00	47.00	47.00	47.00	47.00	47.00	43.00	43.00	43.00	43.00	43.00	43.00
1937	43.00	43.00	46.20	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00
1936	40.00	40.00	40.00	40.00	40.00	38.80	38.00	38.00	38.00	40.00	40.00	40.00
1935	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.50	40.00
1934	36.00	36.00	36.00	37.20	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00
1933	36.20	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	36.00
1932	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1931	35.00	35.00	36.00	36.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
1930	40.00	40.00	38.00	38.00	36.40	36.00	36.00	36.00	36.00	36.00	36.00	35.50
1929	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	40.00	40.00

*Per 100 lbs.

BEEHIVE COKE

Net Ton

Foundry, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$5.75	$6.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.80	6.00	5.75
1938	5.25	5.25	5.25	5.25	5.25	5.05	5.00	5.00	5.00	5.00	5.00	5.05
1937	4.25	4.25	4.25	5.05	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.30
1936	4.00	4.20	4.10	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1935	4.60	4.60	4.60	4.60	4.60	4.60	4.25	4.00	4.00	4.35	4.35	4.25
1934	4.25	4.25	4.25	4.55	4.60	4.60	4.60	4.60	4.60	4.60	4.60	4.60
1933	2.50	2.50	2.25	2.25	2.25	2.40	2.80	3.10	3.15	3.85	4.25	4.25
1932	3.25	3.25	3.25	3.25	3.15	3.00	3.00	2.90	2.75	2.75	2.65	2.50
1931	3.30	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
1930	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1929	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.55	3.50

Furnace, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$5.00
1939	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	4.75	5.00	5.00
1938	4.25	4.25	4.25	4.25	4.25	3.90	3.75	3.75	3.75	3.75	3.75	3.75
1937	4.00	4.00	4.05	4.50	4.85	4.65	4.50	4.50	4.45	4.40	4.37	4.37
1936	3.50	3.50	3.50	3.50	3.50	3.50	3.45	3.45	3.90	4.00	4.00	4.00
1935	3.60	3.60	3.60	3.60	3.60	3.50	3.30	3.25	3.25	3.55	3.55	3.65
1934	3.60	3.50	3.35	3.30	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1933	1.75	1.75	1.75	1.75	1.75	1.80	2.40	2.75	2.50	3.25	3.75	3.75
1932	2.25	2.25	2.25	2.25	2.15	2.00	2.00	2.00	2.00	2.00	1.80	1.80
1931	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40	2.40	2.40	2.35	2.30
1930	3.55	2.60	2.60	2.60	2.55	2.50	2.50	2.50	2.60	2.60	2.55	2.50
1929	2.75	2.90	2.95	2.75	2.75	2.75	2.75	2.75	2.65	2.65	2.65	2.65

STEEL AND IRON SCRAP

Per Gross Ton, Delivered

Heavy Melting Steel, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$18.15	$17.75	$17.05	$16.45	$18.00	$19.90	$19.55	$18.75	$20.15	$21.30	$21.50	$22.50
1939	15.60	15.65	15.75	15.50	14.55	15.00	15.55	16.15	18.75	23.15	21.85	18.50
1938	14.05	14.15	13.65	12.79	11.55	11.40	13.75	15.20	15.25	14.95	14.85	15.75
1937	18.95	19.65	22.40	22.75	19.00	18.40	19.40	21.85	20.40	17.15	14.10	12.75
1936	14.50	14.80	15.75	15.75	14.75	13.80	14.15	16.00	17.75	18.15	17.25	18.50
1935	13.50	13.25	12.40	11.70	12.00	12.25	12.30	13.25	13.45	13.65	13.65	14.05
1934	13.05	13.90	14.35	14.15	12.80	11.90	12.00	11.45	10.75	10.50	11.15	12.95
1933	8.35	8.25	8.75	9.90	11.65	11.65	12.70	13.75	13.00	12.45	11.65	11.50
1932	10.25	10.25	10.25	10.20	9.75	9.00	8.35	8.55	9.50	9.50	9.15	8.75
1931	13.00	12.75	12.90	12.50	11.25	10.30	10.50	10.70	10.80	10.45	10.25	10.25
1930	16.55	16.90	16.60	16.05	15.40	15.10	14.90	15.20	15.70	14.80	12.85	12.75
1929	19.00	18.60	18.50	18.60	17.85	18.30	18.45	18.90	18.45	17.30	16.30	15.10

Heavy Melting Steel, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$16.45	$15.75	$15.50	$15.25	$16.65	$18.00	$17.45	$18.15	$19.30	$19.85	$20.25	$20.60
1939	13.75	14.00	14.25	13.35	12.75	13.38	13.55	13.75	16.05	19.25	17.45	16.25
1938	13.25	12.15	12.20	11.45	11.05	10.25	12.05	14.00	13.60	13.05	14.20	13.75
1937	18.25	19.50	20.90	20.75	17.55	16.00	17.75	19.75	17.85	13.95	12.55	11.50
1936	13.40	14.30	14.75	14.35	13.05	12.75	13.25	15.45	16.15	16.25	16.50	16.50
1935	12.15	11.65	10.45	10.05	10.20	10.25	10.40	12.35	12.55	12.50	13.20	13.75
1934	10.44	10.87	12.00	11.75	11.13	9.75	9.55	9.25	8.65	8.75	9.00	10.15
1933	5.25	5.25	5.25	6.55	8.70	8.80	10.45	10.40	9.95	9.35	8.35	8.75
1932	7.25	6.80	6.75	6.55	6.20	5.60	4.50	5.40	5.75	6.00	5.75	5.50
1931	10.00	9.85	9.75	9.60	8.65	8.50	8.50	8.25	7.95	7.75	7.65	7.50
1930	12.65	13.25	13.20	13.00	12.55	12.05	12.00	12.00	12.25	11.55	10.20	10.00
1929	16.50	16.00	15.55	15.95	15.45	14.95	14.75	15.05	15.05	14.45	13.05	12.50

Heavy Melting Steel, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$18.15	$17.50	$17.15	$16.75	$17.40	$19.65	$19.05	$19.75	$20.70	$20.75	$20.75	$20.75
1939	15.25	15.25	15.37	15.65	15.25	15.44	15.60	16.44	18.95	22.12	20.70	18.85
1938	14.95	14.75	14.44	13.45	12.25	11.85	13.72	14.50	14.25	14.65	14.75	15.20
1937	17.50	18.75	19.75	20.44	18.40	17.03	18.40	19.75	19.22	16.55	14.00	14.00
1936	12.37	13.15	13.46	13.75	12.65	11.70	12.25	13.85	15.37	15.65	14.81	15.63
1935	11.40	11.25	10.60	10.15	10.45	10.45	10.30	11.40	12.20	12.00	12.05	12.25
1934	11.63	11.73	11.70	11.50	11.00	10.40	10.25	9.85	9.60	9.50	9.95	10.85
1933	6.50	6.50	6.50	6.90	9.00	9.50	10.55	12.00	10.70	10.20	9.55	10.50
1932	7.50	7.35	7.35	7.20	6.50	6.25	6.25	6.40	7.25	7.25	7.25	6.50
1931	10.50	10.50	10.50	10.00	9.50	8.75	8.25	8.55	8.75	8.20	7.95	7.50
1930	14.50	14.50	14.95	13.95	13.40	13.25	12.50	12.65	13.00	12.00	11.50	11.00
1929	16.50	16.30	16.25	17.00	16.25	16.25	16.50	16.75	16.37	15.80	15.15	14.50

Compressed Sheets, Detroit (Dealers)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$13.90	$13.65	$13.25	$13.75	$15.65	$17.70	$16.60	$17.25	$17.90	$18.40	$18.15	$18.50
1939	11.95	12.00	12.10	11.50	10.55	11.05	11.95	12.75	14.80	18.25	17.40	14.45
1938	10.50	10.50	9.95	8.45	7.60	7.30	10.20	11.45	11.85	11.65	11.80	11.90
1937	15.75	16.10	18.25	19.15	16.55	15.50	17.00	18.25	17.95	14.15	10.40	10.30
1936	10.45	11.55	12.50	12.10	10.85	10.50	11.05	12.75	14.25	14.40	13.60	13.95
1935	10.00	9.60	7.95	7.75	7.95	8.50	8.75	9.80	10.05	10.05	9.75	9.90
1934	8.50	9.40	10.30	9.70	8.90	7.90	8.00	7.80	7.75	7.50	7.75	9.00
1933	4.00	4.00	4.06	5.15	7.50	7.80	8.85	9.50	8.55	7.35	7.00	7.45
1932	5.55	5.75	5.75	5.70	5.10	4.75	3.75	3.80	5.00	5.50	5.05	4.06
1931	8.92	9.45	9.00	9.00	7.75	6.95	6.95	6.80	6.50	6.15	6.00	6.00
1930	12.00	11.75	11.40	11.25	10.85	10.50	10.50	10.85	11.15	10.90	9.65	8.81
1929	14.65	14.45	14.00	14.00	14.00	13.65	14.00	14.00	14.00	13.40	12.15	11.50

No. 1 Cast, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$20.75	$19.75	$19.70	$19.70	$20.40	$21.65	$21.50	$21.65	$22.25	$22.50	$22.95	$23.25
1939	16.75	16.75	16.75	16.50	16.25	16.25	16.35	16.90	19.75	23.50	22.25	20.95
1938	16.25	16.20	15.75	15.30	14.75	14.75	15.85	16.75	16.75	16.75	16.75	16.75
1937	18.85	19.00	20.69	22.50	20.35	18.81	19.55	21.65	20.50	18.95	16.75	16.25
1936	12.75	13.45	17.00	14.88	14.15	13.75	14.31	15.55	16.62	16.65	16.25	17.75
1935	11.60	11.95	11.75	11.55	11.50	11.50	11.50	11.60	12.25	12.25	12.75	12.75
1934	11.50	11.65	12.30	12.50	12.15	12.00	11.25	11.00	11.00	11.00	11.00	12.25
1933	9.00	9.00	9.00	9.10	10.25	10.35	11.20	11.75	12.40	12.00	11.95	12.00
1932	11.20	10.00	10.00	9.50	9.25	9.00	9.00	9.25	9.25	9.00	9.00	9.00
1931	12.80	13.00	13.00	13.00	12.75	12.50	12.50	12.50	12.50	12.50	11.70	11.50
1930	16.00	15.75	15.75	15.50	15.00	14.75	13.50	13.50	13.50	13.50	13.50	12.50
1929	16.75	16.75	16.50	16.50	16.50	16.50	16.50	16.50	16.25	16.25	16.00	16.00

Cast Borings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$12.00	$9.65	$8.50	$8.85	$9.65	$10.75	$11.40	$12.50	$13.40	$14.00	$14.25	$15.50
1939	8.25	8.25	8.55	8.75	7.35	6.75	8.10	8.95	10.00	12.50	13.80	12.35
1938	7.25	7.25	6.75	6.25	6.25	5.90	7.05	7.75	8.15	8.65	8.50	8.50
1937	14.40	14.00	14.40	14.50	14.10	14.00	14.65	15.20	14.90	12.95	8.75	7.25
1936	8.30	8.75	8.70	8.75	8.75	8.05	7.90	10.90	11.95	11.65	11.50	13.00
1935	6.50	6.90	7.00	6.10	6.00	6.65	6.50	7.00	7.30	8.15	8.15	8.00
1934	7.30	8.15	8.70	8.50	8.25	7.75	7.25	7.05	6.25	5.50	5.90	6.00
1933	5.70	5.70	5.55	5.70	6.90	7.65	9.05	9.80	9.05	8.30	7.60	7.50
1932	6.75	6.50	6.75	6.65	6.40	5.50	4.75	5.15	5.95	6.25	6.50	5.90
1931	7.70	7.70	7.65	7.60	7.50	7.75	7.05	7.50	7.45	7.50	7.10	6.80
1930	11.10	12.00	11.15	10.75	10.50	9.88	8.50	8.50	8.90	8.40	7.75	7.15
1929	12.55	12.25	11.50	12.15	11.55	11.85	12.10	12.50	12.40	11.80	11.15	10.75

Machine Shop Turnings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$12.50	$10.90	$10.45	$10.10	$11.65	$13.50	$14.10	$14.00	$15.40	$15.50	$15.50	$16.25
1939	9.50	9.50	9.65	9.75	8.50	8.25	9.15	10.15	11.65	14.60	14.75	13.15
1938	8.00	8.85	7.75	7.05	6.75	6.30	7.85	9.25	9.45	9.65	9.70	10.00
1937	14.15	14.25	15.55	15.25	14.80	14.00	14.05	15.05	14.75	11.75	8.55	7.25
1936	9.75	10.20	10.50	10.50	9.75	9.40	9.50	10.70	12.40	12.45	11.75	12.90
1935	8.95	8.80	7.40	7.40	8.15	8.25	8.15	8.80	9.55	9.70	9.45	9.65
1934	9.05	10.00	10.75	10.15	8.20	7.45	7.50	8.00	7.30	7.00	7.20	8.50
1933	6.25	6.25	6.30	6.75	8.00	8.40	9.35	10.45	9.75	9.30	8.00	8.00
1932	6.95	7.10	7.25	6.75	6.30	5.25	5.00	5.25	5.95	6.00	6.25	6.00
1931	6.00	6.80	7.80	7.30	6.75	6.50	6.70	7.30	7.50	7.20	7.00	7.00
1930	11.50	11.75	11.00	11.00	10.20	9.50	8.70	8.00	8.00	7.20	6.15	6.00
1929	12.50	11.25	10.65	11.05	11.00	11.35	11.85	12.40	12.00	11.40	10.75	10.25

FINISHED STEEL

Per Pound f. o. b.

Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1939	2.25	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1938	2.45	2.45	2.45	2.45	2.45	2.45	2.25	2.25	2.25	2.25	2.25	2.25
1937	2.20	2.20	2.40	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	2.05	2.05	2.05
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.85	1.90	1.90	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.75	1.75	1.75
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.65	1.65	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.60
1930	1.90	1.85	1.85	1.80	1.75	1.75	1.70	1.65	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.90

Tank Plates, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.55	1.50	1.55	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.65	1.65	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.50
1930	1.90	1.85	1.80	1.80	1.75	1.70	1.65	1.65	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Structural Shapes, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.60	1.60	1.60	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.50
1930	1.90	1.85	1.80	1.80	1.75	1.70	1.65	1.65	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Hot Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.10c	2.10c	2.10c	1.98c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	*2.15	2.15	2.15	2.10	2.15	2.15
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.90	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.65	1.60	1.55	1.55	1.55	1.65	1.75	1.65	1.70	1.75	1.75	1.75
1932	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1931	1.90	1.90	1.90	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1930	2.15	2.10	2.10	2.10	2.00	2.00	2.00	1.95	1.95	1.95	1.90	1.90
1929	2.10	2.10	2.10	2.15	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15

*Succeeded No. 10 blue annealed June 24, 1938.

Cold Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	3.05c	3.05c	3.05c	2.93c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
1939	3.20	3.20	3.20	3.20	3.10	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1938	3.55	3.45	3.45	3.45	3.45	3.45	3.20	3.20	3.20	3.20	3.20	3.20
1937	3.25	3.25	3.50	3.55	2.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
1936	2.95	2.95	2.95	2.95	2.95	2.95	3.05	3.05	3.05	3.05	3.05	3.05
1935	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
1934	2.75	2.75	2.75	3.05	3.15	3.10	2.95	2.95	2.95	2.95	2.95	2.95
1933	2.40	2.45	2.45	2.55	2.55	2.55	2.55	2.60	2.75	2.75	2.75	2.75
1932	2.90	2.85	2.85	2.80	2.80	2.80	2.80	2.70	2.75	2.65	2.60	2.60
1931	3.30	3.30	3.30	3.15	3.05	3.10	3.10	3.10	3.10	3.10	3.10	3.00
1930	3.90	3.90	3.90	3.80	3.80	3.60	3.60	3.60	3.60	3.45	3.35	3.30
1929	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.05	4.00	4.00

No. 24 Galvanized Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c
1939	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1938	3.80	3.80	3.80	3.80	3.80	3.75	3.50	3.50	3.50	3.50	3.50	3.50
1937	3.40	3.40	3.70	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
1936	3.10	3.10	3.10	3.10	3.10	3.10	3.20	3.20	3.20	3.20	3.20	3.35
1935	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
1934	2.85	2.85	2.85	3.10	3.25	3.25	3.10	3.10	3.10	3.10	3.10	3.10
1933	2.70	2.50	2.60	2.65	2.70	2.70	2.85	2.85	2.85	2.85	2.85	2.85
1932	2.80	2.75	2.80	2.85	2.85	2.85	2.85	2.80	2.75	2.80	2.85	2.85
1931	2.90	2.90	2.90	2.85	2.80	2.80	2.90	2.90	2.90	2.90	2.90	2.90
1930	3.35	3.30	3.30	3.30	3.25	3.20	3.15	3.10	3.00	3.00	2.95	2.90
1929	3.60	3.60	3.60	3.65	3.70	3.65	3.60	3.55	3.50	3.50	3.45	3.40

Cold Finished Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c
1939	2.70	2.70	2.70	2.70	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.70	2.70	2.70	2.70	2.70	2.70
1937	2.55	2.55	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.10	2.10	2.10	2.10	2.10	2.15	2.25	2.25	2.25	2.35	2.35	2.55
1935	2.10	2.10	2.10	2.00	1.95	1.95	1.95	1.95	1.95	1.95	1.95	2.05
1934	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1933	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.95	1.95	1.95	1.95	1.95
1932	2.00	2.00	1.90	1.90	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1931	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.00
1930	2.15	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.05	2.00
1929	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.20	2.20

Tin Plate, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1938	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	*5.10	5.00
1937	4.85	4.85	4.85	5.25	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
1936	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1935	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1934	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1933	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.65	4.65	4.65	5.25
1932	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.50	4.25
1931	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.75	4.75	4.75
1930	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.00	5.00	5.00
1929	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35

*Refund of 25 cents per box on all contracts Jan. 1 to Nov. 10, 1938.

Cold Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.80c	2.80c	2.80c	2.68c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c
1939	2.95	2.95	2.95	2.95	2.85	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1938	3.20	3.20	3.20	3.20	3.20	3.10	2.95	2.95	2.95	2.90	2.90	2.90
1937	2.85	2.85	3.15	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
1936	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.80
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1934	2.40	2.40	2.40	2.65	2.80	2.80	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.95	1.80	1.85	1.80	1.90	2.00	2.25	2.25	2.30	2.40	2.40	2.40
1932	2.00	1.90	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.95	2.00	2.00
1931	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.10	2.05
1930	2.70	2.65	2.60	2.55	2.50	2.45	2.45	2.40	2.35	2.35	2.35	2.25
1929	2.85	2.85	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75

Hot Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.10c	2.10c	2.10c	1.98c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	2.15	2.15	2.15	2.10	2.10	2.10
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.95	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.45	1.45	1.45	1.45	1.55	1.55	1.60	1.65	1.70	1.75	1.75	1.75
1932	1.40	1.40	1.40	1.45	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45
1931	1.55	1.55	1.55	1.55	1.50	1.50	1.55	1.55	1.55	1.55	1.50	1.45
1930	1.85	1.80	1.80	1.70	1.70	1.70	1.65	1.65	1.65	1.60	1.55	1.55
1929	1.80	1.85	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90

Plain Wire, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c
1939	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.60	2.60	2.60	2.60	2.60	2.60
1937	2.60	2.60	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.30	2.30	2.30	2.40	2.40	2.40	2.40	2.40	2.40	2.50	2.50	2.60
1935	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1934	2.20	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1933	2.15	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.20
1932	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
1931	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
1930	2.40	2.40	2.40	2.40	2.35	2.30	2.30	2.30	2.30	2.30	2.30	2.25
1929	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40

Wire Nails, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1940	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c
1939	2.45	2.45	2.45	2.45	2.45	2.45	2.40	2.40	2.40	2.50	2.55	2.55
1938	2.75	2.75	2.75	2.75	2.75	2.75	2.45	2.45	2.45	2.45	2.45	2.45
1937	2.25	2.25	2.70	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
1936	2.40	2.40	2.15	2.10	2.10	2.10	2.10	2.10	1.95	2.05	2.05	2.20
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.55	2.40	2.40	2.40	2.40
1934	2.35	2.35	2.35	2.50	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.90	1.85	1.85	1.85	1.85	1.85	2.05	2.10	2.10	2.10	2.10	2.35
1932	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1931	1.90	1.90	1.90	1.90	1.90	1.80	1.85	1.90	1.90	1.90	1.90	1.90
1930	2.35	2.30	2.30	2.25	2.15	2.15	2.10	2.05	2.00	2.00	1.95	1.90
1929	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.50	2.45	2.40	2.40

Rail Steel Bars, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	2.15c	2.15c	2.10c	2.05c	2.05c	2.05c	2.05c	2.05c	2.05c	2.05c	2.10c	2.10c
1939	2.10	2.10	2.10	2.10	2.05	2.00	2.00	2.00	2.03	2.15	2.15	2.15
1938	2.35	2.35	2.35	2.35	2.35	2.35	2.15	2.10	2.10	2.10	2.10	2.10
1937	2.10	2.10	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1936	1.75	1.75	1.75	1.75	1.75	1.75	1.85	1.85	1.85	1.95	1.95	1.95
1935	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1934	1.70	1.70	1.70	1.79	1.85	1.85	1.77	1.75	1.75	1.75	1.75	1.75
1933	1.50	1.45	1.45	1.45	1.50	1.50	1.50	1.50	1.60	1.70	1.70	1.70
1932	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1931	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.50	1.50	1.50
1930	1.85	1.85	1.85	1.85	1.80	1.75	1.75	1.65	1.65	1.65	1.65	1.65
1929	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.95	1.90

Structural Rivets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c	3.40c
1939	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1938	3.60	3.60	3.60	3.60	3.60	3.60	3.40	3.40	3.40	3.40	3.40	3.40
1937	3.25	3.25	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1936	2.90	2.90	2.90	2.90	2.90	2.95	3.05	3.05	3.05	3.05	3.05	3.20
1935	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1934	2.75	2.75	2.75	2.90	3.00	3.00	2.95	2.90	2.90	2.90	2.90	2.90
1933	2.25	2.25	2.25	2.25	2.25	2.35	2.50	2.50	2.50	2.60	2.75	2.75
1932	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1931	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.55	2.30	2.25	2.25
1930	3.10	3.10	3.10	3.10	3.00	2.90	2.90	2.75	2.75	2.75	2.75	2.75
1929	2.85	2.90	2.95	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10

Cast Iron Pipe, Birmingham

6-Inch and larger, per net ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1940	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
1939	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	45.00	45.00	45.00
1938	46.00	46.00	46.00	46.00	46.00	46.00	42.60	42.00	42.00	42.00	42.00	42.00
1937	41.00	41.00	44.75	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
1936	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	41.00
1935	38.00	38.00	38.00	38.50	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00
1934	36.00	36.00	36.00	36.00	36.00	36.40	38.00	38.00	38.00	38.00	38.00	38.00
1933	32.00	32.00	32.00	32.00	32.00	34.25	35.00	35.00	35.00	35.00	35.25	36.00
1932	33.00	32.20	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
1931	37.00	37.00	36.50	35.00	35.00	35.00	35.00	35.00	33.00	33.00	33.00	33.00
1930	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1929	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

Steel, Iron and Scrap Price Composites

Compiled by STEEL

Iron and Steel Price Composite

	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928
Jan.	$37.33	$36.36	$38.95	$36.55	$33.34	$32.58	$31.15	$28.17	$29.65	$31.69	$35.19	$35.94	$33.48
Feb.	37.21	36.37	38.90	36.74	33.48	32.54	31.30	27.94	29.24	31.64	34.92	35.96	33.81
March	37.07	36.40	38.80	39.92	33.20	32.36	31.38	27.92	29.28	31.65	34.79	35.98	33.90
April	36.69	36.34	38 61	40.39	33.10	32.29	32.67	27.78	29.44	31.47	34.16	36.40	33.91
May	37.33	35.80	38 50	40.06	32.92	32.35	32.97	28.33	29.34	31.07	33.49	36.53	33.75
June	37.69	35.69	38 41	39.82	32.79	32.42	32.96	28.71	29.09	30.82	33.28	36.46	33.59
July	37.63	35.82	36 32	40.03	33.49	32.44	32.32	29.67	28.87	30.78	33.00	36.33	33.05
Aug.	37.70	35.95	36 50	40.34	33.88	32.68	32.24	29.92	28.77	30.73	32.90	36.36	33.47
Sept.	37.93	36.67	36.48	40.16	34.15	32.82	32.15	30.36	28.93	30.61	32.76	36.20	33.90
Oct.	38.07	37.62	36.48	39.59	34.67	32.84	32.10	30.53	28.90	30.30	32.35	35.85	34.35
Nov.	38.08	37.50	36.39	38.96	34.65	33.15	32.15	30.25	28.79	30.16	31.95	35.60	34.77
Dec.	.....	37.42	36.36	38.88	35.15	33.31	32.39	31.01	28.28	29.90	31.69	35.43	34.99
Aver.*	37.52	36.50	37.56	39.29	33.73	32.66	32.15	29.22	29.05	30.90	33.37	36.09	33.91

Includes pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, bars, black pipe, rails, alloy steel, hot strip and cast iron pipe at representative centers. *Eleven months.

Finished Steel Price Composite

	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928
Jan.	$56.50	$56.50	$61.70	$55.80	$53.70	$54.00	$51.10	$46.13	$47.28	$49.30	$55.63	$57.83	$55.88
Feb.	56.50	56.50	61.70	55.92	53.70	54.00	51.10	45.35	46.72	49.42	55.03	57.83	56.76
March	56.50	56.50	61.70	60.70	52.32	54.00	51.10	45.60	47.09	49.42	54.88	57.83	57.23
April	55.90	56.50	61.70	61.45	52.20	54.00	53.90	44.94	47.62	49.22	53.66	58.43	56.55
May	56.60	56.00	61.70	61.70	52.20	54.00	54.80	45.10	47.62	49.02	52.60	58.53	56.83
June	56.60	55.70	61.55	61.70	52.20	54.00	55.08	45.30	47.64	48.60	52.37	58.43	56.55
July	56.60	55.62	57.20	61.70	53.40	54.00	54.05	47.20	47.71	48.68	51.90	58.13	56.05
Aug.	56.60	55.60	57.20	61.70	53.40	54.02	54.00	47.50	47.46	48.72	51.72	57.93	56.15
Sept.	56.60	55.60	57.20	61.70	53.10	53.70	54.00	48.52	47.50	48.72	50.87	57.43	56.38
Oct.	56.60	55.90	57.04	61.70	53.90	53.70	54.00	49.20	47.64	48.22	50.13	56.79	56.75
Nov.	56.60	55.90	56.68	61.70	53.90	53.70	54.00	49.20	47.20	48.17	49.62	56.48	57.10
Dec.	56.60	56.50	56.50	61.70	53.90	53.70	54.00	51.10	46.74	47.74	49.30	56.33	57.63
Aver.	56.52	56.07	59.32	60.62	53.16	53.90	53.43	47.09	47.35	48.77	52.31	57.66	56.65

Includes plates, shapes, bars, hot strip, nails, tin plate, pipe.

Steelworks Scrap Price Composite

	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928
Jan.	$17.48	$14.77	$13.85	$18.12	$13.15	$12.03	$11.24	$ 6.23	$ 8.03	$10.49	$14.16	$15.97	$13.50
Feb.	16.98	14.87	13.54	19.19	13.83	11.66	11.72	6.33	7.89	10.39	14.42	16.42	13.50
March	16.47	14.98	13.20	20.95	14.48	10.75	12.30	6.47	7.94	10.38	14.52	16.24	13.41
April	16.00	14.64	12.30	21.27	14.39	10.05	12.15	7.23	7.76	10.12	14.08	16.53	13.54
May	17.18	14.05	11.47	18.49	13.40	10.27	11.30	9.23	7.03	9.31	13.65	16.16	13.62
June	19.03	14.49	10.89	17.15	12.55	10.45	10.32	9.55	6.62	8.84	13.11	16.04	13.10
July	18.56	14.72	13.06	18.51	12.89	10.64	10.30	10.66	6.06	8.70	12.58	16.12	12.57
Aug.	18.71	15.30	14.44	20.41	14.66	12.05	9.98	11.57	6.25	8.79	12.62	16.46	13.10
Sept.	20.05	17.97	14.23	18.99	16.18	12.65	9.45	10.83	7.04	8.82	12.81	16.39	14.03
Oct.	20.56	21.45	14.00	15.93	16.44	12.72	9.40	10.37	6.96	8.50	12.32	15.44	14.94
Nov.	20.72	20.06	14.58	13.32	16.05	12.92	9.82	9.64	6.87	8.22	11.17	14.51	15.22
Dec.	.....	17.88	14.77	13.24	16.92	13.17	11.02	10.12	6.41	8.16	10.77	13.73	15.30
Aver.*	18.34	16.26	13.36	17.96	14.58	11.61	10.75	9.02	7.07	9.23	13.02	15.83	13.82

Includes heavy melting steel and hydraulic compressed sheets at representative centers. *Eleven months.

Domestic Market Summary

(*Concluded from Page* 317)

up $2 in late November. On May 1 Pacific coast steel prices were lifted $1 because of higher ocean freight rates.

Extras on some items were revised, usually resulting in higher net prices. As of March 1 wire producers adopted new extras for second quarter, affecting coated products mostly. Structural extras were revised drastically, as of July 1, succeeding the list of July 1, 1938. The revisions pertained to size, quantity and lengths, with some new classifications and listings, the new schedules taking into account developments in making and fabrication.

Effective July 15, Carnegie-Illinois issued a new list of extras on reinforcing bars, superseding the list of Oct. 1, 1939. Bending extras were cut 10 per cent; the trucking extra was changed from 10 cents to all points to 5 cents, except in the metropolitan New York area and within switching areas of Pittsburgh, Youngstown, Buffalo, Chicago, Gary, Cleveland, Sparrows Point and Birmingham where the 10-cent extra was still to apply. New extras on plates and hot-rolled alloy steel became effective Oct. 1, with prices slightly higher on certain grades and sizes.

For the first time hot-rolled alloy plates received an official listing on Sept. 1, prices previously having been subject to individual negotiation.

Early in January it was announced that ore prices had been named for 1940, unchanged, the earliest since 1917. However by mid-April prices were cut 50 cents per ton when the Oliver Mining Co. advertised ore for sale and prices became established at levels in effect for eight years prior to 1937. Vessels in the Great Lakes reduced freight charges 10 cents per ton.

Pig Iron Prices Advanced

On three occasions pig iron prices were raised, usually only isolated attempts. On July 1 a producer in Utah lifted his price $1 per ton and late in October a producer at Neville Island added $1.50 to $2 per ton. At mid-December a leading merchant furnace interest raised prices and sold several thousand tons in several states at the higher price.

In mid-June ferroalloy prices were raised sharply because of higher prices on the ores, many of which are imported. Ferromanganese was elevated $20 per ton; spiegeleisen, $4 to $10, silicon alloys $5 to $10.

Steel scrap prices moved within narrower limits than during several other recent years. There were many checks and balances to offset unusual developments. Thus when Italy was shut off through the British blockade and 250,000 tons left unshipped, larger scrap shipments to Britain and greater home consumption took care of the situation. Moreover, Japan bought feverishly early in the fall in anticipation of a complete scrap embargo which went into effect on Oct. 16. Earlier the embargo had applied to No. 1 heavy melting steel scrap, but it developed that 70 per cent of Japan's purchases had been of No. 2 grade. Later that was embargoed.

The national defense advisory commission met with scrap dealers in mid-autumn and put on pressure to hold prices steady. STEEL's composite steelworks scrap was declining during the first months of 1940, reaching the low of $15.96 at mid-April. It thereafter recovered fast, standing at $18.67 two months later and reaching $20.71, high for the year, by mid-November.

Progress of the war had considerable bearing on our exports. In the early days Britain was inclined to buy preponderant tonnages of semifinished, but as her industrial works were bombed and there was greater need for speed, finished items ascended. By the end of November 300,000 to 400,000 tons for Britain was under negotiation, with shipments to Canada running 100,000 tons monthly.

Invasion Blocks Exports to Europe

By early April our trade with Scandinavia was crippled because of the German invasion. By the middle of May, Belgium and Holland were lost as customers. These two countries had bought 62,755 tons of steel here during first quarter as against 129,364 tons in all of 1939. However, former customers of Belgium and Luxemburg now came to the United States. In early June, France inquired for 200,000 tons of steel here, mostly shell rounds and the Anglo-French purchasing commission was much enlarged. By late June production on most French orders had ceased for a time after France's fall. Soon, however, the British stated that they would take over most French contracts, making minor changes in specifications. By late July, South American buying here was sluggish because of heavy buying earlier in the year and some tendency towards stagnation in business because of world uncertainties.

As a rule domestic demand for steel was well diversified, with emphasis on heavy steel where deliveries became most belated towards the close of the year. Tin plate was the main exception, hovering around 45 per cent operations during most of the second half. Galvanized sheet production advanced gradually, reaching 82 per cent at the end of November. Oil country pipe moved rather slowly.

By mid-October, sales of fabricated structural steel had passed the total for all of 1939. By the end of November concrete bar sales had exceeded all of 1939. In principal demand during the later months of the year were shapes, plates, bars and alloy steel. Flat-rolled steel, which had been sluggish during most of the summer had become active by mid-fall.

As the year closed considerable discussion centered on whether steel facilities for 1941 will be sufficient. One group of authorities reasoned about as follows: Ingot capacity is now 83,000,000 net tons yearly. Defense program should take the equivalent of 10,000,000 tons yearly, with 9,000,000 tons more representing exports to Great Britain. This 19,000,000 tons subtracted from 83,000,000 leaves 64,000,000 tons which was the ingot capacity for the previous record year, 1929. Thus 64,000,000 tons in 1941 would be left for civilian needs and it is reasoned that it should prove sufficient.

Advertisement JANUARY, 1941

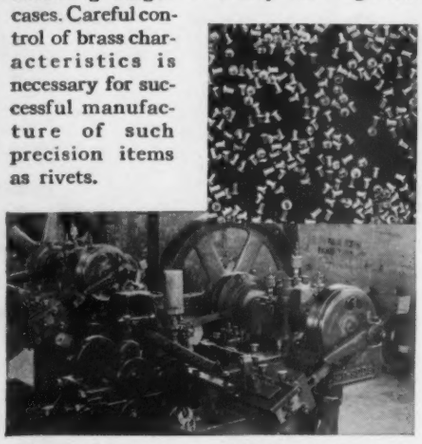
COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared Each Month by the Bridgeport Brass Co. "Bridgeport" *Headquarters for BRASS, BRONZE and COPPER*

Tiny Hollow Rivets Made from Brass Wire

What are probably the smallest hollow rivets being produced commercially are being made by the Milford Rivet & Machine Company from brass wire furnished by Bridgeport. The rivets measure only .082 inch in length. They are produced on automatic machines, into which the brass wire is fed. Emerging from the machines ready for use, the finished rivets are placed in the hopper of a special machine which automatically releases one rivet at a time and peens it over by operation of a lever. This eliminates the need for manual handling and assembling of such tiny rivets, which are generally used for attaching hinges to vanity and cigarette cases. Careful control of brass characteristics is necessary for successful manufacture of such precision items as rivets.



Automatic machinery fabricates tiny hollow rivets from brass wire furnished by Bridgeport. Inset shows the finished rivets, .082 inch long overall.

Brazed Joints Produced Without Softening Metal

Copper and its alloys can now be brazed without causing annealing of the metal, according to claims made for a recently patented process. The method is believed to have special advantages in making joints in metals which depend on cold working for their physical properties.

With conventional brazing methods, it is claimed, the conditions of time and temperature are likely to effect an enlargement of the grain structure, with consequent softening and decrease in tensile strength. This frequently necessitates an additional cold working step to restore the original properties. In the new process, it is said that heat is applied by passage of an electrical current through a transverse section of the joint, and that the current and its time of application are so controlled that substantially no change takes place in the grain structure of the metal.

Simple Precautions Will Prevent Hot Breaks in Brass Fabrication

Understanding of Causes Helps Avert Intercrystalline Cracks Resulting from Combination of Heat and Stress

The copper-zinc alloys are extensively used in a wide variety of applications because of the ease with which they can be fabricated into products of excellent physical properties. They are readily adaptable to most of the commonly used fabricating processes. Occasionally, however, an unusual combination of conditions will cause difficulty in operations normally performed without trouble. The difficulty in cases of this kind can be eliminated once the underlying causes are understood. A typical instance is the occurrence of "hot breaks"—intercrystalline cracks resulting from a combination of heat and stress.

Cause of Hot Breaks in Brass

It is well known that many metals and alloys are fairly brittle at specific temperatures. The exact temperature seems to depend on the rate of application of force or stress. The blue heat brittleness of iron is a familiar example of this characteristic.

In the copper-zinc alloys, particularly the high brass and Muntz metal types of alloy, this brittle temperature range is between 500° and 750° F. The more rapidly force is applied, the more pronounced the brittle effect becomes and the higher the temperature at which brittleness occurs. In impact tests the temperature is about 750° F., while in slower applications of force the temperature at which brittleness occurs decreases. With very slowly applied forces, as in creep tests, no evidence of brittleness can be found.

Occurrence in Practice

From the practical standpoint there are several operations in which such brittleness may occur if the proper precautions are not taken. One of the more obvious cases occurs in handling brass after annealing. If, in removing parts from an annealing furnace before cooling or on dumping into a quench tank, the hot parts are allowed to strike against the container or against each other, cracks may be developed as a result of the combination of the force of the blow and the temperature of the metal. Obviously, the danger is greater in the case of heavy articles. This difficulty is easily prevented by air or water cooling before moving the annealed parts. Fig. 1 shows the structure of a break produced in high brass by a sharp blow at a temperature below that at which color is visible.

A more common case of this type of failure occurs in machining operations. In machining—particularly in drilling or tapping—the metal is subjected to fairly high tensile stresses, which vary with the sharpness of the cutting edges. Moreover, the amount of heat generated is increased as the cutting edge becomes dulled. Dull drills are therefore likely to set up the combination of heat and stress which results in hot breaks.

Coolants Should Be Used

Other combinations of circumstances which result in high temperatures may also cause cracking of the brass. Proper coolants as well as lubricants are therefore extremely important in drilling and tapping operations, where stresses are most likely to be high, and where difficulties in cooling are most pronounced. Fig. 2 shows a section of free cutting brass, illustrating the type of failure caused by dull machining tools.

Another instance of this type of failure may occur in the rolling or beading of cylindrical shells. Here the cause is the heat de-

(*Continued on page 2 col. 2*)

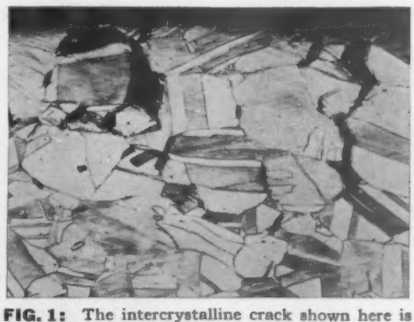


FIG. 1: The intercrystalline crack shown here is the result of a sharp blow while the metal is at black heat. These conditions may occur in handling metal after annealing. Transverse edge section Mag. 75X.

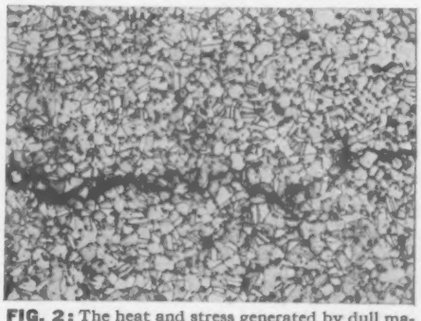


FIG. 2: The heat and stress generated by dull machining tools resulted in the cracking of this section of free machining brass rod. Longitudinal section Mag. 75X.

COPPER ALLOY BULLETIN

ALLOYS OF COPPER

This is the nineteenth of a series of articles on the properties and applications of copper alloys, and continues the subject of modifications of the copper-zinc alloys.

ADDITION OF ALUMINUM TO COPPER-ZINC ALLOYS

Years ago the addition of aluminum to the copper-zinc alloys would never have received serious consideration. Today aluminum is an essential raw material in all brass mills.

The original reluctance to use aluminum was caused by the heavy oxide film which it forms on the surface of molten metal. So strong was this reluctance that the danger of contamination of other scrap by scrap aluminum-bearing alloys was considered to be a sufficient reason for avoiding the manufacture of aluminum-bearing alloys.

Improvements in Casting

Improved methods in the casting shop have completely eliminated this former difficulty. While aluminum still forms a film, means have been developed which enable the casting shop to produce sound metal in spite of the film, and aluminum additions in copper-zinc alloys are now regularly employed to obtain specific advantages.

The addition of aluminum raises the tensile strength of copper-zinc alloys appreciably. The high strength manganese bronzes have always contained more or less aluminum, particularly in the sand cast alloys. In these alloys the high strength has been due more to the aluminum than to the manganese.

Recent Developments

The more recent developments in the use of aluminum additions, however, have been the result of precisely the same property that formerly limited aluminum's usefulness—its ability to form strong, tenacious oxide films. This property is especially advantageous in combatting certain types of corrosion, particularly in condenser tubes. Condenser tube corrosion has increased in recent years because of increased water speeds, with the resulting turbulence and entrapped air. The addition of aluminum increases the strength of the protective film formed, and thus increases resistance to erosion by the high velocity of the water.

Aluminum brass, as this alloy is called, contains about 2% aluminum and 76% copper, with the remainder zinc. Recent experience indicates that this alloy is extremely successful in preventing corrosion of condenser tubes by brackish tidal waters or the sea water used in marine installations.

Wider Uses Seen for Cupro Nickel Alloy

70-30 cupro nickel, which has been extensively used for condenser tubes in marine applications, is finding expanding utility in other fields as well, it is reported. New uses are said to include pipe lines, valves, and fittings for service in which salt water is handled. In applications of this type, the longer service life of cupro nickel, compared with alloys of lower initial cost, frequently results in greater over-all economy.

Memos on Brass—No. 17

The wide range of copper alloys commercially available results in a high degree of adaptability to specific fabricating processes. For example, the lower copper content alloys, such as Muntz metal, are adapted to hot working. The alloys containing 66% or more of copper are suitable for cold working operations.

Simple Precautions Prevent Hot Breaks

(*Continued from page 1 col. 3*)

veloped by slippage of the shell on the arbor or between the roll and the shell, while the stress is provided by the deformation produced by rolling. Similar cracking may also develop in buffing when the buffing mandrel is tapered slightly so as to grip the shell being buffed. Here the cause is the combination of the stress from insertion of the mandrel and the temperature of buffing. In this case, cracking may also occur in shells which contain high residual stresses from drawing or forming operations, in combination with the temperature of the buffing operation.

It will be noted that in each of these cases the cracking results from an unusual combination of circumstances. While the specific solution in each case depends on the individual circumstances, the general nature of the solution is readily suggested by recognition of the fact that the underlying cause is the combination of heat and stress. The cracks occurring in this type of failure are characterized by a distinctive discoloration caused by the high temperature. This discoloration aids in identifying the nature of the failure, and a study of the circumstances will usually offer a guide to the precautions to be observed in preventing a recurrence.

NEW DEVELOPMENTS

A new cleaner is said to be suitable for cathodic cleaning of brass and copper. Maker says that it is readily soluble, cleanses and rinses rapidly, and is economical to use because of its anhydrous compositions. It is described as a medium pH material containing an effective detergent accelerator. **(No. 150)**

A dimension gage can be used for simultaneous checking of several dimensions, such as length, diameter, and depth, it is claimed. It is said that each dimension to be checked has a separate gaging head which actuates signal lights of different colors in indicating whether the dimension is within tolerance, oversize or undersize. **(No. 151)**

Bench tools are reported to be designed for use in the production of small lots of metal stampings and formed parts. Tools are hand-operated, and consist of a die duplicating bender, bench brake, and bench shear. It is said that the tools offer an inexpensive method of making parts that would be fabricated on punch presses for longer runs. **(No. 152)**

A new tool material is said to be especially adaptable to the machining of such materials as hard bronze. Maker claims that it is 15% stronger than other tool materials of the same hardness. Thermal conductivity is said to be the same as similar materials. Hardness is 92.0 Rockwell A and strength in transverse rupture test 223,000 pounds per square inch, it is claimed. **(No. 153)**

Hobbing machines are now being built in standard and precision types, it is reported. Special accessories are available for a wide variety of applications, and include a high-speed hob swivel for fine-pitch and small-diameter work, particularly on brass, it is claimed. **(No. 154)**

A nameplate stamping machine is said to handle parts from 0.0005 to 3¼ inches thick. Letters or numbers can be stamped on assembled parts and on nameplates after assembly, it is reported, provided over-all dimensions do not exceed 9 x 8 x 3¼ inches. **(No. 155)**

A dial micrometer is said to be handy for gaging all types of sheet metal work. It is said to be equipped with an easily readable dial, and to be operated with one hand, leaving the other free to hold the work. Pointer can be set to any desired gage for checking metal to specification, it is reported. **(No. 156)**

Brass shim stock is now packaged in rolls with inch graduations marked along one edge to assist in cutting off desired lengths, according to a recent announcement. It is said that the rolls measure 6 by 100 inches, and are available in a wide range of thicknesses from .001 to .015 inch. **(No. 157)**

This column lists items manufactured or developed by many different sources. Further information on any of them may be obtained by writing Bridgeport Brass Company, which will gladly refer readers to the manufacturer or other source.

PRODUCTS OF THE BRIDGEPORT BRASS COMPANY

Executive Offices: BRIDGEPORT, CONN.—Branch Offices and Warehouses in Principal Cities

SHEETS, ROLLS, STRIPS—*Brass, bronze, copper, Duronze,** for stamping, deep drawing, forming and spinning.

CONDENSER, HEAT EXCHANGER, SUGAR TUBES—For steam surface condensers, heat exchangers, oil refineries, and process industries.

*Trade-name.

PHONO-ELECTRIC* ALLOYS—High-strength bronze trolley, messenger wire and cable.

WELDING ROD—For repairing cast iron and steel, fabricating silicon bronze tanks.

LEDRITE* ROD—For making automatic screw machine products.

BRASS "Bridgeport" CO.

Established 1865

COPPER WATER TUBE—For plumbing, heating, underground piping.

DURONZE ALLOYS—High-strength silicon bronzes for corrosion-resistant connectors, marine hardware; *hot rolled sheets* for tanks, boilers, heaters, flues, ducts, flashings.

BRASS, BRONZE, DURONZE WIRE—For cap and machine screws, wood screws, rivets, bolts, nuts.

FABRICATING SERVICE DEPT.—Engineering staff, special equipment for making parts or complete items.

BRASS AND COPPER PIPE—"Plumrite"* for plumbing, under ground and industrial services.

BRIDGEPORT BRASS

Many 1940 Trends Will Carry-Over This Year

First half output should far exceed 72½ per cent last year. Plates, bars, shapes, alloy steel still lead.

MARKET IN TABLOID ★

Demand
Strong.

Prices
Firm.

Production
Up 15½ points to 95½.

■ PLACING of steel orders both immediately before and after the two holidays was exceedingly and unexpectedly brisk and widely diversified. For many makers and products December shipments exceeded November. Shipments of plates, bars and merchant pipe may have been the largest for any month for all time.

On several products, particularly wide plates, bars and sheets, producers are virtually sold out for first quarter. An independent maker of flat-rolled steel formally withdrew from the market on all his products for first quarter at the start of the week. Though the company was not sold out completely, the action was designed to promote flexibility and enable more efficient allocation of orders on the little still available.

Some other companies are virtually out of the market. Majority of makers keep in the market, placing orders on books for delivery when material is available.

Steel ingot production last week recovered 15½ points to 95½ per cent, which is a half point higher than immediately preceding the holidays.

Several large tonnage orders were placed the last week of 1940. Sales of fabricated structurals were double the weekly average for the year, mainly because of placement of 23,000 tons for shipbuilding extensions at Fore river yards, Quincy, Mass., with the Bethlehem Steel Co., one of the largest contracts of the year. A bridge award at New London, Conn., involved 13,500 tons. At New York pending work is heavy, bridges accounting for 20,000 tons, shipyards for 25,000 tons and shop additions several thousand tons. A St. Louis steelmaker bought 20,000 to 25,000 tons of No. 2 heavy melting steel scrap.

Automobile production is scheduled to drop 5855 units for the week ended Jan. 4 to 76,690 which compares with 87,510 in the corresponding week of last year.

An unusually large number of locomotive orders were placed the last week of the year, largely diesel-electric switch engines. Considerable number of freight cars are on inquiry.

Philadelphia warehouses raised prices of hot-rolled sheets and strip 20 cents per 100 pounds, as of Jan. 2, because of tightening of the mill market.

Despite the uncertain outlook in world affairs generally, trends in the steel industry are perhaps more plainly discernible than usual at the beginning of a year. Production apparently will be much higher than for the first half of 1940. Whereas in 1940 large percentages were used in extending and equipping plants, a greater ratio will be employed as raw materials for those new plants in 1941.

Wide plates may be the scarcest finished steel item, partly because of extensive loss of ships. Bars seem destined to be continually brisk due to diverse uses. Shapes will continue active since the defense building program is by no means completed. Alloy steel will stand among leading descriptions because of the many adaptations to defense. Sheets and strips will have many defense uses, such as roofing for cantonments and other structures, military kitchen equipment, service automobiles and trucks.

Though tin plate was relatively inactive in 1940, it may be otherwise in 1941. Stocks have been reduced. More canned foods will be used to feed soldiers, and there will be many military uses, such as for oil containers. Wire products should be more active early this year as farm demand is revived. Rails and accessories will be needed to keep our defense transportation adequate. Despite increase of welding, bolts, nuts, rivets and screws will find diversified uses in airplane, truck, railroad and miscellaneous consumption. Merchant pipe should be active.

Ingot production in New England last week fell 5 points to 85 per cent. In other districts they gained and as follows: Pittsburgh 20½ to 95½ per cent, Chicago 20 to 99½, Youngstown 14 to 92, Wheeling 20 to 96, Cleveland 12 to 84, Buffalo 15 to 93, Birmingham 16 to 100, Cincinnati 14 to 87, St. Louis 8 to 87½, Detroit 14 to 90 and eastern Pennsylvania 13 to 95.

STEEL's composite prices rose 25 cents for steelworks scrap to $21.71 and 4 cents for iron and steel to $38.47, remaining at $56.60 for finished steel.

COMPOSITE MARKET AVERAGES

	Jan. 4	Dec. 28	Dec. 21	One Month Ago Dec., 1940	Three Months Ago Oct., 1940	One Year Ago Jan., 1940	Five Years Ago Jan., 1936
Iron and Steel....	$38.47	$38.43	$38.32	$38.30	$38.07	$37.33	$33.34
Finished Steel	56.60	56.60	56.60	56.60	56.60	56.50	53.70
Steelworks Scrap..	21.71	21.46	21.37	21.37	20.56	17.48	13.15

Iron and Steel Composite:—Pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, bars, black pipe, rails, alloy steel, hot strip, and cast iron pipe at representative centers. Finished Steel Composite:—Plates, shapes, bars, hot strip, nails, tin plate, pipe. Steelworks Scrap Composite:—Heavy melting steel and compressed sheets.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	Jan. 4, 1941	Dec. 1940	Oct. 1940	Jan. 1940
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.47	2.47	2.47	2.47
Iron bars, Chicago	2.25	2.25	2.25	2.15
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.215	2.215	2.215	2.215
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.10	2.10	2.10	2.10
Plates, Philadelphia	2.15	2.15	2.15	2.15
Plates, Chicago	2.10	2.10	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.50	3.50	3.50	3.50
Sheets, hot-rolled, Gary	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Gary	3.50	3.50	3.50	3.50
Bright bess., basic wire, Pitts.	2.60	2.60	2.60	2.60
Tin plate, per base box, Pitts.	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.55	2.55	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	34.00
Wire rods No. 5 to ⅜-inch, Pitts.	2.00	2.00	2.00	2.00

Pig Iron

	Jan. 4, 1941	Dec. 1940	Oct. 1940	Jan. 1940
Bessemer, del. Pittsburgh	$25.34	$24.95	$24.34	$24.34
Basic, Valley	23.50	23.10	22.50	22.50
Basic, eastern, del. Philadelphia	25.34	24.84	24.34	24.34
No. 2 foundry, Pittsburgh	25.21	24.80	24.21	24.21
No. 2 foundry, Chicago	24.00	23.75	23.00	23.22
Southern No. 2, Birmingham	19.38	19.38	19.38	19.38
Southern No. 2, del. Cincinnati	23.06	23.06	23.06	23.06
No. 2X, del. Phila. (differ. av.)	26.215	25.715	25.215	25.215
Malleable, Valley	24.00	23.60	23.00	23.00
Malleable, Chicago	24.00	23.75	23.00	23.00
Lake Sup., charcoal, del. Chicago	30.34	30.34	30.34	30.34
Gray forge, del. Pittsburgh	24.17	23.35	23.17	23.17
Ferromanganese, del. Pittsburgh	125.33	125.33	125.33	105.33

Scrap

Heavy melt. steel, Pitts.	$23.25	$22.75	$21.30	$18.15
Heavy melt. steel, No. 2, E. Pa.	19.75	19.75	19.75	16.81
Heavy melting steel, Chicago	20.75	20.70	19.85	16.45
Rails for rolling, Chicago	25.00	25.00	24.05	19.05
Railroad steel specialties, Chicago	24.25	23.95	23.25	18.50

Coke

Connellsville, furnace, ovens	$5.50	$5.50	$4.75	$4.75
Connellsville, foundry, ovens	6.00	6.00	5.75	5.75
Chicago, by-product fdry., del.	11.75	11.75	11.75	11.25

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Except when otherwise designated, prices are base, f.o.b. cars.

Sheet Steel

Hot Rolled

Pittsburgh	2.10c
Chicago, Gary	2.10c
Cleveland	2.10c
Detroit, del.	2.20c
Buffalo	2.10c
Sparrows Point, Md.	2.10c
New York, del.	2.34c
Philadelphia, del.	2.27c
Granite City, Ill.	2.20c
Middletown, O.	2.10c
Youngstown, O.	2.10c
Birmingham	2.10c
Pacific Coast ports	2.65c

Cold Rolled

Pittsburgh	3.05c
Chicago, Gary	3.05c
Buffalo	3.05c
Cleveland	3.05c
Detroit, delivered	3.15c
Philadelphia, del.	3.37c
New York, del.	3.39c
Granite City, Ill.	3.15c
Middletown, O.	3.05c
Youngstown, O.	3.05c
Pacific Coast ports	3.70c

Galvanized No. 24

Pittsburgh	3.50c
Chicago, Gary	3.50c
Buffalo	3.50c
Sparrows Point, Md.	3.50c
Philadelphia, del.	3.67c
New York, delivered	3.74c
Birmingham	3.50c
Granite City, Ill.	3.60c
Middletown, O.	3.50c
Youngstown, O.	3.50c
Pacific Coast ports	4.05c

Black Plate, No. 29 and Lighter

Pittsburgh	3.05c
Chicago, Gary	3.05c
Granite City, Ill.	3.15c

Long Ternes No. 24 Unassorted

Pittsburgh, Gary	3.80c
Pacific Coast	4.55c

Enameling Sheets

	No. 10	No. 20
Pittsburgh	2.75c	3.35c
Chicago, Gary	2.75c	3.35c
Granite City, Ill.	2.85c	3.45c
Youngstown, O.	2.75c	3.35c
Cleveland	2.75c	3.35c
Middletown, O.	2.75c	3.35c
Pacific Coast	3.40c	4.00c

Corrosion and Heat-Resistant Alloys

Pittsburgh base, cents per lb.

Chrome-Nickel

	No. 302	No. 304
Bars	24.00	25.00
Plates	27.00	29.00
Sheets	34.00	36.00
Hot strip	21.50	23.50
Cold strip	28.00	30.00

Straight Chromes

	No. 410	No. 430	No. 442	No. 446
Bars	18.50	19.00	22.50	27.50
Plates	21.50	22.00	25.50	30.50
Sheets	26.50	29.00	32.50	36.50
Hot strip	17.00	17.50	24.00	35.00
Cold stp.	22.00	22.50	32.00	52.00

Steel Plate

Pittsburgh	2.10c
New York, del.	2.29c
Philadelphia, del.	2.15c
Boston, delivered	2.46c
Buffalo, delivered	2.33c
Chicago or Gary	2.10c
Cleveland	2.10c
Birmingham	2.10c
Coatesville, Pa.	2.10c
Sparrows Point, Md.	2.10c
Claymont, Del.	2.10c
Youngstown	2.10c
Gulf ports	2.45c
Pacific Coast ports	2.65c

Steel Floor Plates

Pittsburgh	3.35c
Chicago	3.35c
Gulf ports	3.70c
Pacific Coast ports	4.00c

Structural Shapes

Pittsburgh	2.10c
Philadelphia, del.	2.21½c
New York, del.	2.27c
Boston, delivered	2.41c
Bethlehem	2.10c
Chicago	2.10c
Cleveland, del.	2.30c
Buffalo	2.10c
Gulf ports	2.45c
Birmingham	2.10c
St. Louis, del.	2.34c
Pacific Coast ports	2.75c

Tin and Terne Plate

Tin Plate, Coke (base box)

Pittsburgh, Gary, Chicago	$5.00
Granite City, Ill.	5.10

Mfg. Terne Plate (base box)

Pittsburgh, Gary, Chicago	$4.30
Granite City, Ill.	4.40

Bars

Soft Steel

(Base, 20 tons or over)

Pittsburgh	2.15c
Chicago or Gary	2.15c
Duluth	2.25c
Birmingham	2.15c
Cleveland	2.15c
Buffalo	2.15c
Detroit, delivered	2.25c
Philadelphia, del.	2.47c
Boston, delivered	2.52c
New York, del.	2.49c
Gulf ports	2.50c
Pacific Coast ports	2.80c

Rail Steel

(Base, 5 tons or over)

Pittsburgh	2.15c
Chicago or Gary	2.15c
Detroit, delivered	2.25c
Cleveland	2.15c

Buffalo	2.15c
Birmingham	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.80c

Iron

Chicago	2.25c
Philadelphia, del.	2.37c
Pittsburgh, refined	3.50-3.00c
Terre Haute, Ind.	2.15c

Reinforcing

New Billet Bars, Base

Chicago, Gary, Buffalo, Cleve., Birm., Young., Sparrows Pt., Pitts.	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.60c

Rail Steel Bars, Base

Pittsburgh, Gary, Chicago, Buffalo, Cleveland, Birm.	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.60c

Wire Products

Pitts.-Cleve.-Chicago-Birm. base per 100 lb. keg in carloads

Standard and cement coated wire nails	$2.55

(Per Pound)

Polished fence staples	2.55c
Annealed fence wire	3.05c
Galv. fence wire	3.40c
Woven wire fencing (base C. L. column)	67
Single loop bale ties, (base C.L. column)	56
Galv. barbed wire, 80-rod spools, base column	70
Twisted barbless wire, column	70

To Manufacturing Trade

Base, Pitts. - Cleve. - Chicago Birmingham (except spring wire)	
Bright bess., basic wire.	2.60c
Galvanized wire	2.60c
Spring wire	3.20c
Worcester, Mass., $2 higher on bright basic and spring wire.	

Cut Nails

Carload, Pittsburgh, keg $3.85

Cold-Finished Bars

	Carbon	Alloy
Pittsburgh	2.65c	3.35c
Chicago	2.65c	3.35c
Gary, Ind.	2.65c	3.35c
Detroit	2.70c	*3.45c
Cleveland	2.65c	3.35c
Buffalo	2.65c	3.35c

*Delivered.

Alloy Bars (Hot)

(Base, 20 tons or over)

Pittsburgh, Buffalo, Chicago, Massillon, Canton, Bethlehem	2.70c
Detroit, delivered	2.80c

S.A.E.	Alloy Diff.	S.A.E.	Alloy Diff.
2000	0.35	3100	0.70
2100	0.75	3200	1.35
2300	1.70	3300	3.80
2500	2.55	3400	3.20

4100 0.15 to 0.25 Mo.	0.55
4600 0.20 to 0.30 Mo. 1.50-2.00 Ni.	1.20
5100 0.80-1.10 Cr.	0.45
5100 Cr. spring flats	0.15
6100 bars	1.20
6100 spring flats	0.85
Cr. N., Van.	1.50
Carbon Van.	0.85
9200 spring flats	0.15
9200 spring rounds, squares	0.40

Electric furnace up 50 cents.

Alloy Plates (Hot)

Pittsburgh, Chicago, Coatesville, Pa.	3.50c

Strip and Hoops

(Base, hot strip, 1 ton or over; cold, 3 tons or over)

Hot Strip, 12-inch and less

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, Birmingham	2.10c
Detroit, del.	2.20c
Philadelphia, del.	2.42c
New York, del.	2.46c
Pacific Coast ports	2.75c
Cooperage hoop, Young., Pitts.; Chicago, Birm.	2.20c
Cold strip, 0.25 carbon and under, Pittsburgh, Cleveland, Youngstown	2.80c
Chicago	2.90c
Detroit, del.	2.90c
Worcester, Mass.	3.00c

Carbon	Cleve.,	Pitts.
0.26—0.50	2.80c	
0.51—0.75	4.30c	
0.76—1.00	6.15c	
Over 1.00	8.35c	

Worcester, Mass. $4 higher.

Commodity Cold-Rolled Strip

Pitts.-Cleve.-Youngstown	2.95c
Chicago	3.05c
Detroit, del.	3.05c
Worcester, Mass.	3.35c

Lamp stock up 10 cents.

Rails, Fastenings

(Gross Tons)

Standard rails, mill	$40.00
Relay rails, Pittsburgh 20—100 lbs.	32.50-35.50
Light rails, billet qual., Pitts., Chicago, B'ham.	$40.00
Do., rerolling quality	39.00

Cents per pound

Angle bars, billet, mills	2.70c
Do., axle steel	2.35c
Spikes, R. R. base	3.00c
Track bolts, base	4.15c
Car axles forged, Pitts., Chicago, Birmingham.	3.15c
Tie plates, base	2.15c

Base, light rails 25 to 60 lbs., 20 lbs., up $2; 16 lbs. up $4; 12 lbs. up $8; 8 lbs. up $10. Base railroad spikes 200 kegs or more; base plates 20 tons.

Bolts and Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%.

Carriage and Machine

½ x 6 and smaller	68 off
Do., ⅝ and ⅝ x 6-in. and shorter	66 off
Do., ¾ to 1 x 6-in. and shorter	64 off
1⅛ and larger, all lengths	62 off
All diameters, over 6-in. long	62 off
Tire bolts	52.5 off

Stove Bolts

In packages with nuts separate 73-10 off; with nuts attached 73 off; bulk 81 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Step bolts	60 off
Plow bolts	68.5 off

Nuts

Semifinished hex.	U.S.S.	S.A.E.
⅛-inch and less.	66	70
⅛-1-inch	63	65
1⅛-1⅛-inch	61	62
1⅛ and larger	60	..

Hexagon Cap Screws

Upset 1-in., smaller	68 off

Square Head Set Screws

Upset, 1-in., smaller	74.0 off
Headless set screws	64.0 off

Piling

Pitts., Chgo., Buffalo	2.40c

Rivets, Washers

F.o.b. Pitts., Cleve., Chgo., Bham.

Structural	3.40c
⅛-inch and under	65-10 off
Wrought washers, Pitts., Chi., Phila., to jobbers and large nut, bolt mfrs. l.c.l. $5.40; c.l. $5.75	off

Welded Iron, Steel Pipe

Base discounts on steel pipe. Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less on lap weld, 1 point less on butt weld. Chicago delivery 2½ and 1½ less, respectively. Wrought pipe, Pittsburgh base.

Butt Weld

Steel

In.	Blk.	Galv.
⅛	63½	54
¼	66½	58
1—3	68½	60½

Iron

¾	30	13
1—1¼	34	19
1½	38	21½
2	37½	21

Lap Weld

Steel

2	61	52½
2½—3	64	55½
3½—6	66	57½
7 and 8	65	55½

Iron

2	30½	15
2½—3½	31½	17½
4	33½	21
4½—8	32½	20
9—12	28½	15

Line Pipe

Steel

1 to 3, butt weld	67½
2, lap weld	60
2½ to 3, lap weld	63
3½ to 6, lap weld	65
7 and 8, lap weld	64

Iron

	Blk.	Galv.
¾ butt weld	25	7
1 and 1¼ butt weld	29	13
1½ butt weld	33	15½
2 butt weld	32½	15
1½ lap weld	23½	7
2 lap weld	25½	9
2½ to 3½ lap weld	26½	11½
4 lap weld	28½	15
4½ to 8 lap weld	27½	14
9 to 12 lap weld	23½	9

Boiler Tubes

Carloads minimum wall seamless steel boiler tubes, cut-lengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½" O.D.	13	$ 9.72	$23.71
1¾" O.D.	13	11.06	22.93
2" O.D.	13	12.38	19.35
2¼" O.D.	13	13.79	21.68
2¼" O.D.	12	15.16	.....
2½" O.D.	12	16.58	26.57
2¾" O.D.	12	17.54	29.00
3" O.D.	12	18.35	31.36
3½" O.D.	11	23.15	39.81
4" O.D.	10	28.66	49.90
5" O.D.	9	44.25	73.93
6" O.D.	7	68.14	.....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O.D.	13	$ 7.82	$ 9.01
1¼" O.D.	13	9.26	10.67
1½" O.D.	13	10.23	11.79
1¾" O.D.	13	11.64	13.42
2" O.D.	13	13.04	15.03
2¼" O.D.	13	14.54	16.78
2¼" O.D.	12	16.01	18.45
2½" O.D.	12	17.54	20.21
2¾" O.D.	12	18.59	21.42
3" O.D.	12	19.50	22.48
3½" O.D.	11	24.62	28.37
4" O.D.	10	30.54	35.20
4½" O.D.	10	37.35	43.04
5" O.D.	9	46.87	54.01
6" O.D.	7	71.96	82.93

Cast Iron Pipe

Class B Pipe—Pet Net Ton

6-in., & over, Birm.	$45.00-46.00
4-in., Birmingham	48.00-49.00
4-in., Chicago	56.80-57.80
6-in. & over, Chicago	53.80-54.80
6-in. & over, east fdy.	49.00
Do., 4-in.	52.00

Class A Pipe $3 over Class B Stnd. fitgs., Birm., base $100.00.

Semifinished Steel

Rerolling Billets, Slabs

(Gross Tons)

Pittsburgh, Chicago, Gary, Cleve., Buffalo, Youngs., Birm., Sparrows Point	$34.00
Duluth (billets)	36.00
Detroit, delivered	36.00

Forging Quality Billets

Pitts., Chi., Gary, Cleve., Young, Buffalo, Birm.	40.00
Duluth	42.00

Sheet Bars

Pitts., Cleveland, Young., Sparrows Point, Buffalo, Canton, Chicago	34.00
Detroit, delivered	36.00

Wire Rods

Pitts., Cleveland, Chicago, Birmingham No. 5 to ⅜-inch incl. (per 100 lbs.)	$2.00
Do., over ⅜ to 11/32-in. incl.	2.15

Worcester up $0.10; Galveston up $0.25; Pacific Coast up $0.50.

Skelp

Pitts., Chi., Youngstown, Coatesville, Sparrows Pt.	1.90c

Coke

Price Per Net Ton

Beehive Ovens

Connellsville, fur.	$5.00- 5.75
Connellsville, fdry.	5.25- 6.00
Connell, prem. fdry	6.00- 6.60
New River fdry.	6.50- 7.00
Wise county fdry	5.50- 6.50
Wise county fur.	5.00- 5.25

By-Product Foundry

Newark, N. J., del.	11.85-12.50
Chicago, outside del.	11.00
Chicago, delivered	11.75
Terre Haute, del.	11.25
Milwaukee, ovens	11.75
New England, del.	12.50
St. Louis, del.	11.75
Birmingham, ovens	7.50
Indianapolis, del.	11.25
Cincinnati, del.	11.00
Cleveland, del.	11.55
Buffalo, del.	11.75
Detroit, del.	11.50
Philadelphia, del.	11.63

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol	14.00c
Toluol, two degree	27.00c
Solvent naphtha	26.00c
Industrial xylol	26.00c

Per lb. f.o.b. Frankford and St. Louis

Phenol (less than 1000 lbs.)	13.75c
Do. (1000 lbs. or over)	12.75c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls. to jobbers	7.00c

Per ton, bulk, f.o.b. port

Sulphate of ammonia	$30.00

Pig Iron

Delivered prices include switching charges only as noted. No. 2 foundry is 1.75-2.25 sil.; 25c diff. for each 0.25 sil. above 2.25 sil.; 50c diff. below 1.75 sil. Gross tons.

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$24.00	$24.50	$23.50	$25.00
Birmingham, Ala.‡	19.38	....	18.38	24.00
Birdsboro, Pa.	25.00	25.50	24.50	26.00
Buffalo	24.00	24.50	23.00	25.00
Chicago	24.00	24.00	23.50	24.50
Cleveland	24.00	24.00	23.50	24.50
Detroit	24.00	24.00	23.50	24.50
Duluth	24.50	24.50	.....	25.00
Erie, Pa.	24.00	24.50	23.50	25.00
Everett, Mass.	25.00	25.50	24.50	26.00
Granite City, Ill.	24.00	24.00	23.50	24.50
Hamilton, O.	24.00	24.00	23.50	.....
Neville Island, Pa.	24.00	24.00	23.50	24.50
Provo, Utah	22.00	.	.	.
Sharpsville, Pa.	24.00	24.00	23.50	24.50
Sparrow's Point, Md.	24.00	.....	23.50	.....
Swedeland, Pa.	25.00	25.50	24.50	26.00
Toledo, O.	24.00	24.00	23.50	24.50
Youngstown, O.	24.00	24.00	23.50	24.50

‡Subject to 38 cents deduction for 0.70 per cent phosphorus or higher.

Delivered from Basing Points:				
Akron, O., from Cleveland	25.39	25.39	24.89	25.89
Baltimore from Birmingham	24.78	.....	23.66	. .
Boston from Birmingham	24.12	.	.	.
Boston from Everett, Mass.	25.50	26.00	25.00	26.50
Boston from Buffalo	25.50	26.00	25.00	26.50
Brooklyn, N. Y., from Bethlehem	26.50	27.00	.....	.....
Canton, O., from Cleveland	25.39	25.39	24.89	25.89
Chicago from Birmingham	†23.22	.	.	.
Cincinnati from Hamilton, O.	24.24	25.11	24.61	.....
Cincinnati from Birmingham	23.06	.....	22.06	.
Cleveland from Birmingham	23.32	..	22.82	.
Mansfield, O., from Toledo, O.	25.94	25.94	25.44	25.44
Milwaukee from Chicago	25.10	25.10	24.60	25.60
Muskegon, Mich., from Chicago, Toledo or Detroit	27.19	27.19	26.69	27.69
Newark, N. J., from Birmingham	25.15	.	..	.
Newark, N. J., from Bethlehem	25.53	26.03	.....	.....
Philadelphia from Birmingham	24.46	...	23.96	.....
Philadelphia from Swedeland, Pa.	25.84	26.34	25.34	.....
Pittsburgh district from Neville Island	Neville base, plus 69c, 84c, and $1.24 freight.			
Saginaw, Mich., from Detroit	26.31	26.31	25.81	26.81
St. Louis, northern	24.50	24.50	24.00	.....
St. Louis from Birmingham	†23.12	..	22.62	.
St. Paul from Duluth	26.63	26.63	.....	27.13

†Over 0.70 phos.

Low Phos.

Basing Points: Birdsboro and Steelton, Pa., and Buffalo, N. Y., $29.50, base; $30.74 delivered Philadelphia.

Gray Forge		Charcoal	
Valley furnace	$23.50	Lake Superior fur.	$27.00
Pitts. dist. fur.	23.50	do., del. Chicago	30.34
		Lyles, Tenn.	26.50

†Silvery

Jackson county, O., base: 6-6.50 per cent $29.50; 6.51-7—$30.00; 7-7.50—$30.50; 7.51-8—$31.00; 8-8.50—$31.50; 8.51-9—$32.00; 9-9.50—$32.50; Buffalo, $1.25 higher.

Bessemer Ferrosilicon†

Jackson county, O., base; Prices are the same as for silveries, plus $1 a ton.

†The lower all-rail delivered price from Jackson, O., or Buffalo is quoted with freight allowed.

Manganese differentials in silvery iron and ferrosilicon, 2 to 3%, $1 per ton add. Each unit over 3%, add $1 per ton.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$60.80

First Quality

Pa., Ill., Md., Mo., Ky.	47.50
Alabama, Georgia	47.50
New Jersey	52.50

Second Quality

Pa., Ill., Ky., Md., Mo.	42.75
Georgia, Alabama	34.20
New Jersey	49.00

Ohio

First quality	39.90
Intermediate	36.10
Second quality	31.35

Malleable Bung Brick

All bases	$56.05

Silica Brick

Pennsylvania	$47.50
Joliet, E. Chicago	55.10
Birmingham, Ala.	47.50

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$28.00
Wire cut	26.00

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26 00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$50.00
Chem. bonded chrome	50.00
Magnesite brick	72.00
Chem. bonded magnesite	61.00

Fluorspar

Washed gravel, duty pd., tide, net ton	$25.00-$26.00
Washed gravel, f.o.b. Ill., Ky., net ton, carloads, all rail	20.00-21.00
Do. barge	20.00
No. 2 lump	20.00-21.00

Ferroalloy Prices

Ferromanganese, 78-82%, carlots, duty pd. $120.00
Ton lots 130.00
Less ton lots 133.50
Less 200 lb. lots 138.00
Do., carlots del. Pitts. 125.33

Spiegeleisen, 19-21% dom.
Palmerton, Pa., spot 36.00
Do., 26-28% 49.50

Ferrosilicon, 50%, freight allowed, c.l. 74.50
Do., ton lot 87.00
Do., 75 per cent 135.00
Do., ton lots 151.00
Spot, $5 a ton higher.

Silicomanganese, c.l., 3 per cent carbon 113.00
2½% carbon 118.00
2% carbon, 123.00; 1%, 133.00
Contract ton price $12.50 higher; spot $5 over contract.

Ferrotungsten, stand., lb. con. del. cars 1.90-2.00

Ferrovanadium, 35 to 40%, lb., cont. 2.70-2.80-2.90

Ferrophosphorus, gr. ton, c.l., 17-18% Rockdale, Tenn., basis, 18%, $3 unitage, 58.50; electric furn., per ton, c. l., 23-26% f.o.b. Mt. Pleasant, Tenn., 24% $3 unitage 75.00

Ferrochrome, 66-70 chromium, 4-6 carbon, cts. lb., contained cr., del. carlots 11.00c
Do., ton lots 11.75c
Do., less-ton lots 12.00c
less than 200 lb. lots 12.25c

67-72% low carbon:

	Carloads	Ton lots	Less ton
2% carb.	17.50c	18.25c	18.75c
1% carb.	18.50c	19.25c	19.75c
0.10% carb.	20.50c	21.25c	21.75c
0.20% carb.	19.50c	20.25c	20.75c

Spot ¼c higher

Ferromolybdenum, 55-65% molyb. cont., f.o.b. mill, lb. 0.95

Calcium molybdate, lb. molyb. cont., f.o.b. mill 0.80

Ferrotitanium, 40-45%, lb., con. ti., f.o.b. Niagara Falls, ton lots $1.23
Do., less-ton lots 1.25
20-25% carbon, 0.10 max., ton lots, lb. 1.35
Do., less-ton lots 1.40
Spot 5c higher

Ferrocolumbium, 50-60%, contract, lb. con. col., f.o.b. Niagara Falls $2.25
Do., less-ton lots 2.30
Spot is 10c higher

Technical molybdenum trioxide, 53 to 60% molybdenum, lb. molyb. cont., f.o.b. mill 0.80

Ferro-carbon-titanium, 15-18%, ti., 6-8% carb., carlots, contr., net ton $142.50
Do., spot 145.00
Do., contract, ton lots 145.00
Do., spot, ton lots 150.00

15-18% ti., 3-5% carbon, carlots, contr., net ton 157.50
Do., spot 160.00
Do., contract, ton lots 160.00
Do., spot, ton lots 165 00

Alsifer, contract carlots, f.o.b. Niagara Falls, lb. 7.50c
Do., ton lots 8.00c
Do., less-ton lots 8.50c
Spot ½c lb. higher

Chromium Briquets, contract, freight allowed, lb. carlots, bulk 7.00c
Do., ton lots 7.50c
Do., less-ton lots 7.75c
Do., less 200 lbs. 8.00c
Spot, ¼c higher.

Tungsten Metal Powder, according to grade, spot shipment, 200-lb. drum lots, lb. $2.50
Do., smaller lots 2.60

Vanadium Pentoxide, contract, lb. contained $1.10
Do., spot 1.15

Chromium Metal, 98% cr., contract, lb. con. chrome, ton lots 80.00c
Do., spot 85.00c
88% chrome, cont. tons 79.00c
Do., spot 84.00c

Silicon Metal, 1% iron, contract, carlots, 2 x ⅛-in., lb. 14.50c
Do., 2% 13.00c
Spot ¼c higher

Silicon Briquets, contract carloads, bulk, freight allowed, ton $74.50
Ton lots 84.50
Less-ton lots, lb. 4.00c
Less 200 lb. lots, lb. 4.25c
Spot ¼-cent higher.

Manganese Briquets, contract carloads, bulk freight allowed, lb. 5.50c
Ton lots 6.00c
Less-ton lots 6.25c
Spot ¼c higher

Zirconium Alloy, 12-15%, contract, carloads, bulk, gross ton 102.50
Do., ton 108.00
35-40%, contract, carloads, lb., alloy 14.00c
Do., ton lots 15.00c
Do., less-ton lots 16.00c
Spot ¼c higher

Molybdenum Powder, 99%, f.o.b. York, Pa. 200-lb. kegs, lb. $2.60
Do., 100-200 lb. lots 2.75
Do., under 100-lb. lots 3.00

Molybdenum Oxide Briquets, 48-52% molybdenum, per pound contained, f.o.b. producers' plant 80.00c

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials

	Soft Bars	Bands	Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets: Hot Rolled	Sheets: Cold Rolled	Sheets: Galv. No. 24	Cold Rolled Strip	Cold Drawn Bars: Carbon	Cold Drawn Bars: S.A.E. 2300	Cold Drawn Bars: S.A.E. 3100
Boston	3.98	3.86	4.86	3.85	3.85	5.66	3.51	4.48	5.11	3.46	4.13	8.88	7.23
New York (Met.)	3.84	3.76	3.76	3.76	3.75	5.56	3.38	4.40	5.00	3.51	4.09	8.84	7.19
Philadelphia	3.85	3.95	4.45	3.55	3.55	5.25	3.55	4.05	4.65	3.31	4.06	8.56	7.16
Baltimore	3.85	4.00	4.35	3.70	3.70	5.25	3.50	....	5.05	....	4.05	....	....
Norfolk, Va.	4.00	4.10	....	4.05	4.05	5.45	3.85	....	5.40	....	4.15	....	....
Buffalo	3.35	3.62	3.62	3.62	3.40	5.25	3.05	4.30	4.60	3.22	3.75	8.40	6.75
Pittsburgh	3.35	3.40	3.40	3.40	3.40	5.00	3.15	....	4.45	....	3.65	8.40	6.75
Cleveland	3.25	3.30	3.30	3.40	3.58	5.18	3.15	4.05	4.62	3.20	3.75	8.40	6.75
Detroit	3.43	3.23	3.48	3.60	3.65	5.27	3.23	4.30	4.64	3.20	3.80	8.70	7.05
Omaha	3.90	3.80	3.80	3.95	3.95	5.55	3.45	....	5.00	....	4.42	....	....
Cincinnati	3.60	3.47	3.47	3.65	3.68	5.28	3.22	4.00	4.67	3.47	4.00	8.75	7.10
Chicago	3.50	3.40	3.40	3.55	3.55	5.15	3.05	4.10	4.60	3.30	3.75	8.40	6.75
Twin Cities	3.75	3.65	3.65	3.80	3.80	5.40	3.30	4.35	4.75	3.83	4.34	9.09	7.44
Milwaukee	3.63	3.53	3.53	3.68	3.68	5.28	3.18	4.23	4.73	3.54	3.88	8.38	6.68
St. Louis	3.62	3.52	3.52	3.47	3.47	5.07	3.18	4.12	4.87	3.41	4.02	8.52	7.12
Kansas City	4.05	4.15	4.15	4.00	4.00	5.60	3.90	....	5.00	....	4.30	....	....
Indianapolis	3.60	3.55	3.55	3.70	3.70	5.30	3.25	....	4.76	....	3.97	....	....
Memphis	3.90	4.10	4.10	3.95	3.95	5.71	3.85	....	5.25	....	4.31	....	....
Chattanooga	3.80	4.00	4.00	3.85	3.85	5.68	3.70	....	4.40	....	4.39	....	....
Tulsa, Okla.	4.44	4.34	4.34	4.49	4.49	6.09	3.99	....	5.54	....	4.69	....	....
Birmingham	3.50	3.70	3.70	3.55	3.55	5.88	3.45	....	4.75	....	4.43	....	....
New Orleans	4.00	4.10	4.10	3.80	3.80	5.75	3.85	....	4.80	5.00	4.60	....	....
Houston, Tex.	3.50	5.95	5.95	3.85	3.85	5.50	4.20	....	5.25	....	6.60	....	....
Seattle	4.00	3.85	5.20	4.00	4.00	5.75	4.00	6.50	5.00	....	5.75	....	....
Portland, Oreg.	4.25	4.50	6.10	4.00	4.00	5.75	3.95	6.50	4.75	....	5.75	....	....
Los Angeles	4.15	4.60	6.45	4.15	4.15	6.40	4.30	6.50	5.25	....	6.60	10.55	9.80
San Francisco	3.50	4.00	6.00	3.50	3.50	5.60	3.40	6.40	5.15	....	6.80	10.65	9.80

	S.A.E. Hot-rolled Bars (Unannealed): 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series
Boston	4.28	7.75	6.05	5.80	7.90
New York (Met.)	4.04	7.60	5.90	5.65	....
Philadelphia	4.10	7.31	5.86	5.61	8.56
Baltimore	4.45	....	....	....	....
Norfolk, Va.	....	....	....	....	....
Buffalo	3.55	7.35	5.65	5.40	7.50
Pittsburgh	3.40	7.45	6.00	5.75	7.85
Cleveland	3.30	7.55	5.85	5.85	7.70
Detroit	3.48	7.67	5.97	5.72	7.19
Cincinnati	3.65	7.69	5.99	5.74	7.84
Chicago	3.70	7.35	5.65	5.40	7.50
Twin Cities	3.95	7.70	6.00	6.09	8.19
Milwaukee	3.83	7.33	5.88	5.63	7.73
St. Louis	3.82	7.47	6.02	5.77	7.87
Seattle	5.85	....	8.00	7.85	8.65
Portland, Oreg.	5.70	8.85	8.00	7.85	8.65
Los Angeles	4.80	9.55	8.55	8.40	9.05
San Francisco	5.00	9.65	8.80	8.65	9.30

BASE QUANTITIES

Soft Bars, Bands, Hoops, Plates, Shapes, Floor Plates, Hot Rolled Sheets and SAE 1035-1050 Bars: Base, 400-1999 pounds; 300-1999 pounds in Los Angeles; 400-39,999 (hoops, 0-299) in San Francisco; 300-4999 pounds in Portland, Seattle; 400-14,999 pounds in Twin Cities; 400-3999 pounds in Birmingham.

Cold Rolled Sheets: Base, 400-1499 pounds in Chicago, Cincinnati, Cleveland, Detroit, New York, Kansas City and St. Louis; 450-3749 in Boston; 500-1499 in Buffalo; 1000-1999 in Philadelphia, Baltimore; 750-4999 in San Francisco; 300-4999 in Portland, Oreg.; any quantity in Twin Cities; 300-1999 in Los Angeles.

Galvanized Sheets: Base, 150-1499 pounds, New York; 150-1499 in Cleveland, Pittsburgh, Baltimore, Norfolk; 150-1049 in Los Angeles; 800-4999 in Portland, Seattle; 450-3749 in Boston; 500-1499 in Birmingham, Buffalo, Chicago, Cincinnati, Detroit Indianapolis, Milwaukee, Omaha, St. Louis, Tulsa; 1500 and over in Chattanooga; any quantity in Twin Cities; 750-1500 in Kansas City; 150 and over in Memphis; 25 to 49 bundles in Philadelphia; 750-4999 in San Francisco.

Cold Rolled Strip: No base quantity; extras apply on lots of all size.

Cold Finished Bars: Base, 1500 pounds and over on carbon, except 0-299 in San Francisco, 1000 and over in Portland, Seattle; 1000 pounds and over on alloy, except 0-4999 in San Francisco.

SAE Hot Rolled Alloy Bars: Base, 1000 pounds and over, except 0-4999, San Francisco; 0-1999, Portland, Seattle.

CURRENT IRON AND STEEL PRICES OF EUROPE

Dollars at $4.02½ per Pound Sterling

Export Prices f.o.b. Port of Dispatch—

By Cable or Radio

	BRITISH Gross Tons f.o.b. U.K. Ports	£	s	d
Merchant bars, 3-inch and over	$66.50	16	10	0
Merchant bars, small, under 3-inch, re-rolled	3.60c	20	0	0
Structural shapes	2.79c	15	10	0
Ship plates	2.90c	16	2	6
Boiler plates	3.17c	17	12	6
Sheets, black, 24 gage	4.00c	22	5	0
Sheets, galvanized, corrugated, 24 gage	4.61c	25	12	6
Tin plate, base box, 20 x 14, 108 pounds	$ 6.29	1	11	4

British ferromanganese $120.00 delivered Atlantic seaboard duty-paid.

Domestic Prices Delivered at Works or Furnace—

		£	s	d
Foundry No. 3 Pig Iron, Silicon 2.50—3.00	$25.79	6	8	0(a)
Basic pig iron	24.28	6	0	6(a)
Furnace coke, f.o.t. ovens	7.15	1	15	6
Billets, basic soft, 100-ton lots and over	49.37	12	5	0
Standard rails, 60 lbs. per yard, 500-ton lots & over	2.61c	14	10	6
Merchant bars, rounds and squares, under 3-inch	3.17c	17	12	0 ††
Shapes	2.77c	15	8	0 ††
Ship plates	2.91c	16	3	0 ††
Boiler plates	3.06c	17	0	6 ††
Sheets, black, 24 gage, 4-ton lots and over	4.10c	22	15	0
Sheets, galvanized 24 gage, corrugated, 4-ton lots & over	4.70c	26	2	6
Plain wire, mild drawn, catch weight coils, 2-ton lots and over	4.28c	23	15	0
Bands and strips, hot-rolled	3.30c	18	7	0 ††

(a) del. Middlesbrough. 5s rebate to approved customers. ††Rebate of 15s on certain conditions.

IRON AND STEEL SCRAP PRICES

Corrected to Friday night. Gross tons delivered to consumers except where otherwise stated; †indicates brokers prices

HEAVY MELTING STEEL

Birmingham, No. 1	19.00
Bos. dock No. 1 exp.	17.00-17.25
New Eng. del. No. 1	18.25-18.50
Buffalo, No. 1	23.00-23.50
Buffalo, No. 2	21.00-21.50
Chicago, No. 1	20.50-21.00
Chicago, auto, no alloy	19.50-20.00
Cincinnati, dealers	19.50-20.00
Cleveland, No. 1	22.00-22.50
Cleveland, No. 2	21.00-21.50
Detroit, No. 1	†18.50-19.00
Detroit, No. 2	†17.50-18.00
Eastern Pa., No. 1	21.00-21.50
Eastern Pa., No. 2	19.50-20.00
Federal, Ill., No. 2	17.75-18.25
Granite City, R. R. No. 1	18.75-19.25
Granite City, No. 2	17.75-18.25
Los Ang., No. 1 net	13.00-13.50
Los Ang., No. 2 net	12.00-12.50
N. Y. dock No. 1 exp.	†17.00
Pitts., No. 1 (R. R.)	23.50-24.00
Pittsburgh, No. 1	23.00-23.50
Pittsburgh, No. 2	21.00-21.50
St. Louis, No. 1	18.75-19.25
St. Louis, No. 2	17.75-18.25
San Fran., No. 1 net	13.50-14.00
San Fran., No. 2 net	12.50-13.00
Seattle, No. 1	15.00
Toronto, dirs., No. 1	11.00-11.25
Valleys, No. 1	23.50-24.00

COMPRESSED SHEETS

Buffalo	21.00-21.50
Chicago, factory	20.00-20.50
Chicago, dealers	18.50-19.00
Cincinnati, dealers	18.50-19.00
Cleveland	21.50-22.00
Detroit	†20.00-20.50
E. Pa., new mat.	21.00-21.50
E. Pa., old mat.	18.00-18.50
Los Angeles, net	9.75-10.25
Pittsburgh	23.00-23.50
St. Louis	15.50-16.00
San Francisco, net	10.00-10.50
Valleys	22.00-22.50

BUNDLED SHEETS

Buffalo, No. 1	21.00-21.50
Buffalo, No. 2	19.50-20.00
Cleveland	17.00-17.50
Pittsburgh	21.50-22.00
St. Louis	14.00-14.50
Toronto, dealers	9.75

SHEET CLIPPINGS, LOOSE

Chicago	15.00-15.50
Cincinnati, dealers	14.00-14.50
Detroit	†16.50-17.00
St. Louis	13.50-14.00
Toronto, dealers	9.00

BUSHELING

Birmingham, No. 1	17.00
Buffalo, No. 1	21.00-21.50
Chicago, No. 1	19.50-20.00
Cincin., No. 1 deal.	16.00-16.50
Cincin., No. 2 deal.	9.00- 9.50
Cleveland, No. 2	14.50-15.00
Detroit, No. 1 new	†19.50-20.00
Valleys, new, No. 1	22.50-23.00
Toronto, dealers	5.50- 6.00

MACHINE TURNINGS (Long)

Birmingham	8.50
Buffalo	15.00-15.50
Chicago	15.00-15.50
Cincinnati, dealers	11.50-12.00
Cleveland, no alloy	13.50-14.00
Detroit	†12.75-13.25
Eastern Pa.	15.50-16.00
Los Angeles	4.00- 5.00
New York	†10.50-11.00
Pittsburgh	16.00-16.50
St. Louis	12.25-12.75
San Francisco	5.00
Toronto, dealers	7.25- 7.50
Valleys	15.00-15.50

SHOVELING TURNINGS

Buffalo	16.00-16.50
Cleveland	15.00-15.50
Chicago	14.75-15.25
Chicago, spcl. anal.	15.50-16.00
Detroit	†13.75-14.25
Pitts., alloy-free	17.00-17.50

BORINGS AND TURNINGS
For Blast Furnace Use

Boston district	†9.75-10.50
Buffalo	15.00-15.50
Cincinnati, dealers	10.75-11.25
Cleveland	15.00-15.50
Eastern Pa.	14.00-14.50
Detroit	†13.50-14.00
New York	†10.00-10.50
Pittsburgh	16.00-16.50
Toronto, dealers	7.00- 7.25

AXLE TURNINGS

Buffalo	18.00-18.50
Boston district	†12.50-13.00
Chicago, elec. fur.	20.50-21.00
East. Pa. elec. fur.	19.50-20.00
St. Louis	15.00-15.50
Toronto	7.25- 7.50

CAST IRON BORINGS

Birmingham	8.50
Boston dist. chem.	†11.00-11.25
Buffalo	15.00-15.50
Chicago	14.50-15.00
Cincinnati, dealers	10.75-11.25
Cleveland	14.50-15.00
Detroit	†13.50-14.00
E. Pa., chemical	15.50-16.00
New York	†11.50-12.00
St. Louis	12.00-12.50
Toronto, dealers	7.25- 7.50

RAILROAD SPECIALTIES

Chicago	24.00-24.50

ANGLE BARS—STEEL

Chicago	23.75-24.25
St. Louis	22.25-22.75

SPRINGS

Buffalo	26.50-27.00
Chicago, coil	25.00-25.50
Chicago, leaf	24.00-24.50
Eastern Pa.	26.00-26.50
Pittsburgh	27.50-28.00
St. Louis	23.50-24.00

STEEL, RAILS, SHORT

Birmingham	21.00
Buffalo	26.00-26.50
Chicago (3 ft.)	24.00-24.50
Chicago (2 ft.)	25.00-25.50
Cincinnati, dealers	26.75-27.25
Detroit	†24.00-24.50
Pitts., 2 ft. and less	27.00-27.50
St. L. 2 ft. & less	24.50-25.00

STEEL RAILS, SCRAP

Birmingham	19.00
Boston district	†16.50-17.50
Buffalo	22.50-23.00
Chicago	20.50-21.00
Cleveland	25.50-26.00
Pittsburgh	24.00-24.50
St. Louis	22.00-22.50
Seattle	18.00-18.50

PIPE AND FLUES

Chicago, net	14.50-15.00
Cincinnati, dealers	14.25-14.75

RAILROAD GRATE BARS

Buffalo	14.50-15.00
Chicago, net	14.25-14.75
Cincinnati, dealers	14.25-14.75
Eastern Pa.	19.00-19.50
New York	†13.00-13.50
St. Louis	14.50-15.00

RAILROAD WROUGHT

Birmingham	17.00
Boston district	†11.75-12.25
Eastern Pa., No 1	20.00-20.50
St. Louis, No. 1	16.00-16.50
St. Louis, No. 2	17.50-18.00

FORGE FLASHINGS

Boston district	†14.25-14.50
Buffalo	19.50-20.00
Cleveland	19.00-19.50
Detroit	†18.75-19.25
Pittsburgh	21.00-21.50

FORGE SCRAP

Boston district	†12.75-13.00
Chicago, heavy	25.00-25.50

LOW PHOSPHORUS

Buffalo, plates	26.50-27.00
Cleveland, crops	27.00-27.50
Eastern Pa., crops	25.00-25.50
Pitts., billet, bloom. slab crops	28.00-28.50

LOW PHOS. PUNCHINGS

Buffalo	26.00-26.50
Chicago	24.50-25.00
Cleveland	23.00-23.50
Detroit	†21.50-22.00
Eastern Pa.	25.00-25.50
Pittsburgh	27.00-27.50
Seattle	15.00

RAILS FOR ROLLING
5 feet and over

Birmingham	20.00
Boston	†18.50-19.00
Chicago	24.75-25.25
New York	†19.50-20.00
Eastern Pa.	26.00-26.50
St. Louis	24.50-25.00

STEEL CAR AXLES

Birmingham	19.00
Boston district	†20.00-21.00
Chicago, net	26.25-26.75
Eastern Pa.	27.50-28.00
St. Louis	26.00-26.50

LOCOMOTIVE TIRES

Chicago (cut)	24.50-25.00
St. Louis, No. 1	21.50-22.00

SHAFTING

Boston district	†19.75-20.00
New York	†21.00-21.50
Eastern Pa.	25.00-25.50
St. Louis, 1¼-3¾"	20.00-20.50

CAR WHEELS

Birmingham, iron	20.00
Boston dist., iron	†16.00-16.50
Buffalo, steel	26.50-27.00
Chicago, iron	21.50-22.00
Chicago, rolled steel	24.50-25.00
Cincin., iron deal.	21.00-21.50
Eastern Pa., iron	23.00-23.50
Eastern Pa., steel	26.00-26.50
Pittsburgh, iron	23.00-23.50
Pittsburgh, steel	27.50-28.00
St. Louis, iron	22.00-22.50
St. Louis, steel	23.50-24.00

NO. 1 CAST SCRAP

Birmingham	18.50
Boston, No. 1 mach.	†17.50-18.00
N. Eng., del. No. 2	18.25-18.75
N. Eng. del. textile	22.00-23.00
Buffalo, cupola	20.00-20.50
Buffalo, mach.	21.00-21.50
Chicago, agri. net	16.50-17.00
Chicago, auto net	19.00-19.50
Chicago, railr'd net	17.75-18.25
Chicago, mach. net	19.50-20.00
Cincin., mach. deal.	22.75-23.25
Cleveland, mach.	24.00-24.50
Detroit, cupola, net	†18.50-19.00
Eastern Pa., cupola	24.00-24.50
E. Pa., No. 2	20.00-20.50
E. Pa., yard fdry.	20.00
Los Angeles	16.50-17.00
Pittsburgh, cupola	22.50-23.00
San Francisco	11.00-13.00
Seattle	14.00-15.00
St. L., agri. mach.	19.50-20.00
St. L., No. 1 mach.	20.75-21.75
Toronto, No. 1 mach., net dealers	18.00-18.50

HEAVY CAST

Boston dist. break.	†16.25-16.50
New England, del.	17.00-17.50
Buffalo, break	19.00-19.50
Cleveland, break, net	18.50-19.00
Detroit, auto net	†19.00-19.50
Detroit, break.	†17.00-17.50
Eastern Pa.	22.00-22.50
Los Ang., auto. net.	13.00-14.00
New York break	†17.00

STOVE PLATE

Birmingham	12.00-13.00
Boston district	†16.00-16.50
Buffalo	18.00-18.50
Chicago, net	14.00-14.50
Cincinnati, dealers	14.25-14.75
Detroit, net	†13.00-13.50
Eastern Pa.	18.00-18.50
New York fdry.	†15.00-15.50
St. Louis	15.25-15.75
Toronto dealers, net	12.00

MALLEABLE

New England, del.	22.00-23.00
Buffalo	24.50-25.00
Chicago, R. R.	24.50-25.00
Cincin. agri., deal.	19.00-19.50
Cleveland, rail	25.00-25.50
Eastern Pa., R. R.	22.50-23.00
Los Angeles	12.50
Pittsburgh, rail	26.50-27.00
St. Louis, R. R.	22.50-23.00

Ores

Lake Superior Iron Ore

Gross ton, 51½ % Lower Lake Ports

Old range bessemer	$4.75
Mesabi nonbessemer	4.45
High phosphorus	4.35
Mesabi bessemer	4.60
Old range nonbessemer	4.60

Eastern Local Ore

Cents, unit, del. E. Pa.

Foundry and basic 56-63%, contract	10.00

Foreign Ore

Cents per unit, c.i.f. Atlantic ports

Manganiferous ore, 45-55% Fe., 6-10% Mang.	Nom.
N. African low phos	nom.
Spanish, No. African basic, 50 to 60%	nom.
Chinese wolframite, net ton, duty pd.	$23.50-24.00
Brazil iron ore, 68-69%, ord.	7.50c
Low phos. (.02 max.)	8.00c
F.O.B. Rio Janeiro.	
Scheelite, imp.	$25.00
Chrome ore, Indian, 48% gross ton, cif.	$28.00-30.00

Manganese Ore

Including war risk but not duty, cents per unit cargo lots.

Caucasian, 50-52%	.....
So. African, 50-52%	54.00-55.00
Indian, 49-50%	54.00
Brazilian, 46%	50.00
Cuban, 50-51%, duty free	67.50

Molybdenum

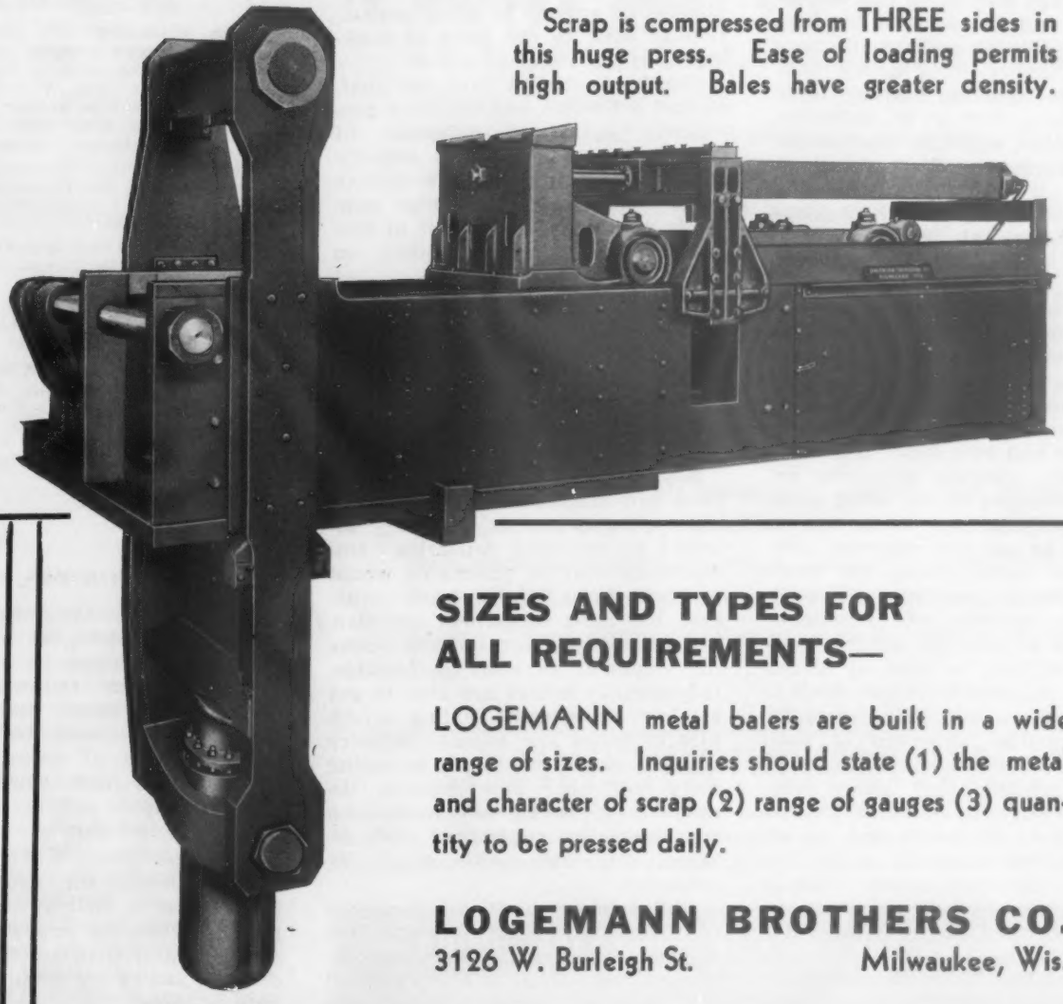
Sulphide conc., lb., Mo. cont., mines	$0.75

SHEET SCRAP?

Bale it in a LOGEMANN SCRAP PRESS

"Hydraulic-compressed" scrap pressed in LOGEMANN metal balers, commands the best price at all times. It can be more conveniently stored and more economically handled.

It can be readily held for favorable markets. It practically eliminates corrosion, saves much heat in remelting. It easily loads cars to capacity.



Scrap is compressed from THREE sides in this huge press. Ease of loading permits high output. Bales have greater density.

SIZES AND TYPES FOR ALL REQUIREMENTS—

LOGEMANN metal balers are built in a wide range of sizes. Inquiries should state (1) the metal and character of scrap (2) range of gauges (3) quantity to be pressed daily.

LOGEMANN BROTHERS CO.
3126 W. Burleigh St. Milwaukee, Wis.

Sheets, Strip

Sheet & Strip Prices, Pages 330, 331

Cleveland—Some makers have withdrawn from the market for first quarter, which is designed to enable producers to choose more carefully what orders they will accept and promote greater flexibility. Regular customers are usually well placed on order books and remaining available tonnages will be distributed where they will do most good. Many tentative orders for second quarter appear, often placed merely in files, without formal acknowledgment, to be booked later. Other companies are formally booking them now.

Chicago—Sheet and strip orders have failed to decline as it was expected they might late in December. Demand is holding up extremely well, in spite of the holiday closedown and deliveries are slightly more extended. All consuming lines show strength.

Boston—With few exceptions, dependent on infrequent gaps in rolling schedules, narrow cold strip deliveries on the more standard finishes now range 10 to 12 weeks. Stainless and specialties are further extended and the demand for both is heavy. Buying and specifications continue higher than heavy shipments and incoming tonnage tends to increase. Hot strip deliveries, falling behind schedule, tend to further complicate re-rolling operations. Capacity for first quarter shipment is practically sold out with backlogs large. Additional second quarter tonnage is being taken at open prices.

New York—Sheet sellers have little to offer before the middle of March and most are practically out of the market for first quarter and in some cases beyond. This applies to hot and cold sheets in particular and in a lesser degree to galvanized. Despite generally extended deliveries on the latter product, some offerings of seven to eight weeks are still reported. Jobbers have been among the more active buyers recently, showing particular concern over possibility of a price advance for second quarter and wishing to build up stocks as much as possible before April 1.

More narrow cold strip orders for second quarter shipment at open prices are being booked, incoming volume holding well above shipments. Deliveries on some finishes range up to 18 weeks and on all have lengthened rapidly in the last month as backlogs mount. This is being accompanied by uncertain deliveries on hot strip, notably for specialties.

Philadelphia—Sheet deliveries are lengthening with little tonnage available before March and some producers practically sold out for this quarter. Fear of priorities is inducing some consumers not identified with defense work to build up inventories.

Cincinnati—Sheet mill schedules for first quarter are nearly filled. One mill has announced it is out of the market, which may be a conservative position lest a later press of national defense demands disturb commitments. Another mill is booking second quarter sheet tonnage, at prices then prevailing.

Plates

Plate Prices, Page 330

Pittsburgh—December production and delivery of plates, according to advance reports, were the heaviest of the year, although major producers here expect that with added capacity for heat treating and fabricating work, output of carbon steel plates and alloy plates, particularly armor plate, will be substantially stepped up during 1941. Work is going forward at least four points in the district toward that aim. Continuous strip mills are allotting more tonnage to production of light plate in an attempt to bring production at least to the level of bookings.

Cleveland—Orders have not abated and deliveries become more prolonged. A larger proportion of sales is for second quarter delivery at prices prevailing at time of shipment. News of more new shipyards and ships to be built in this country causes more concern on future plate supply.

Chicago—Bookings of plates exceed shipments, and deliveries are lengthening gradually. Second quarter delivery is the best that can be promised. Operations of plate fabricators and heavy equipment manufacturers are near capacity.

Boston—Mounting plate specifications are accompanied by substantial buying which is adversely affected by extended deliveries. Undoubtedly current purchases would be heavier but for the latter situation, but most consumers are placing wanted tonnage on mill books for shipment as soon as possible. Infrequently sellers are able to get a place on current rolling schedules to better the average delivery on light plates, but this is becoming more difficult. Miscellaneous demand is improving and most such consumers are confronted with delayed shipments with small inventories.

Philadelphia — Plate bookings continue fully equal to shipments of most producers, with average deliveries on large sizes extended well into the latter part of this quarter. Mills frequently are forced to decline orders from other than regular customers.

Toronto, Ont.—Large plate orders are under preparation in connection with new shipbuilding operations to get under way at the beginning of the year. Practically all this new business will go to the United States, it is stated, as Canadian production is fully absorbed.

Plate Contracts Placed

565 tons, fabricated high-strength low-alloy steel plates with one lot of eyebolts, nosing plate, bolts and cap screws, Panama, schedule 4621, to Bethlehem Steel Export Co., New York, $69,045.94, bids Dec. 23.

Unstated tonnage, 200,000-gallon elevated steel water tank, Duncan Field, Texas, to Pittsburgh-Des Moines Steel Co., Pittsburgh; bids Dec. 6.

Unstated tonnage, 250,000-gallon elevated steel water tank, Middletown, Pa., air depot, to Chicago Bridge & Iron Co., Chicago, $17,450, bids Dec. 14, constructing quartermaster.

Plate Contracts Pending

988 tons, fabricated high-strength low-alloy steel plates with one lot eyebolts, nosing plate, bolts and cap screws, Panama, schedule 4673, bids Jan. 9, Washington.

500 tons or more, peg top buoys, navy department, various deliveries, Greenville Steel Car Co., Greenville, Pa., low, schedule 4531.

350 tons, estimated, two diesel-electric seagoing hopper dredges, afloat, Delaware river, Fort Mifflin, Philadelphia, Pusey & Jones Corp., Wilmington, Del., low, $1,687,356 first dredge, $1,517,659, second dredge, with other alternates, low, bids to United States engineer, Philadelphia, inv. 123.

100 tons or more, 300,000-gallon elevated steel water tank, Scott Field, Ill.; bids in Jan. 3, inv. 72.

Unstated, six 300-foot seaplane tenders; Lake Washington Shipyards, Seattle, general contractor.

Unstated, four 300-foot seaplane tenders; Associated Shipbuilders, Seattle, general contractor.

Unstated tonnage, one steel hull for drill barge, Panama, schedule 4592, Darby Products of Steel Plate Corp., Kansas City, Kans., low, item 1a, $197,389, bids Dec. 20.

Bars

Bar Prices, Page 330

Pittsburgh — December output was heavy despite the holiday period, and backlogs on alloy bars continue to rise. Deliveries are indefinite; on some items orders placed now cannot be delivered until the end of second quarter. Specifications and releases have been coming in actively on carbon and alloy steel bars.

Cleveland—Some makers are sold up completely for first quarter. Orders for a holiday week have probably been the largest on record, much greater than anticipated. Individual orders are small but aggregate is large.

Chicago—Business continues at

about the same level as early December. Demand is well diversified, both as to consuming industry and as to bar types, with alloy analyses by far the strongest. Forge shops are fully booked for first quarter.

Boston—Bar inventories held by consumers and distributors are moderate. On some sizes and finishes stocks are light and broken. Consumption is mounting and broadening with the peak for defense needs expected to be reached late this quarter or the first of next. Deliveries are lengthening and shipments, with mill capacity sold up well through first quarter on numerous alloys, are delayed further.

New York—Bar sellers enter the new year booked up almost solidly for first quarter and in most cases well beyond on alloy specially heat treated grades. Some sellers of the latter claim they have little capacity left for 1941. Some deliveries of hot carbon bars are still available in 10 to 11 weeks, but they are the exception, and shipments on cold-drawn bars upon occasion are available before the end of the quarter, but these cases are almost without exception where cold drawers happen to have hot bars in stock.

Philadelphia—Bar mill backlogs are heavy but deliveries are in somewhat better shape than in some other products. In some instances 60 to 90 days is available on carbon material, with most buyers covered on requirements during the intervening period. Heavier consumption by defense industries is in prospect within the next few months as a result of enlarged manufacturing facilities.

Buffalo—Spirited demand for steel bars showed no abating over the holidays. Mills announce first quarter tonnage has just about been sold-out. With consumers working pretty much hand to mouth inventory periods are to be short. Buying is very miscellaneous.

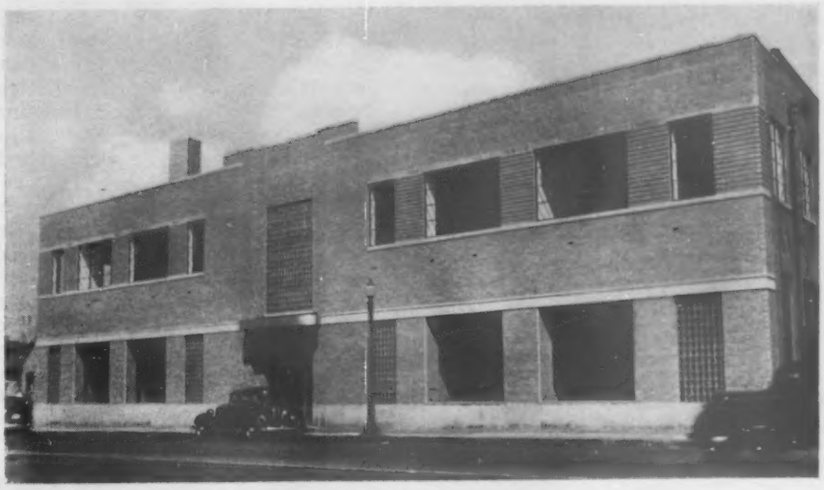
Wire

Wire Prices, Page 331

Pittsburgh — Bookings of manufacturers' wire products and some merchant items are quite active. Backlogs continue to pile up in alloy rods, with deliveries now indefinitely in the future. Prices on merchant specialties have stiffened considerably.

Chicago — Orders for wire and wire products are holding at a high level. Production capacity is operating close to maximum, although governed somewhat by difficulty in obtaining sufficient semifinished. Orders exceed production, thus deliveries are lengthening.

Boston—Limited only by rod supplies, wire mill production remains



WHEELING CORRUGATING COMPANY

USES Carey PRODUCTS

IN MODERN SAINT LOUIS WAREHOUSE

■ The St. Louis branch office and warehouse of the Wheeling Corrugating Company is one of the most modern and best equipped sales and service buildings in the Middle West. Walls, floor and roof are of steel construction. The steel roof deck is covered with insulation board, over which a CAREY Built-Up Roof was applied by the Missouri Roofing Company.

CAREY Impervo (anti-sweat) Cold Pipe Insulation covers the refrigerated water lines of the air-conditioning system. Hot water pipes are insulated with CAREYCEL Pipe Covering. To eliminate noise, warehouse floors are insulated with CAREY Rock Wool.

CAREY Products are known from coast to coast for their dependability, long life, high efficiency. Make your buildings really modern and efficient—reduce upkeep—by using CAREY Products of Asphalt, Asbestos and Magnesia. Write today for book—"Proved Protection Against Wasted Profits"—address Dept. 71.

INDUSTRIAL BUILDING PRODUCTS OF
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Roofing . . . Siding . . . Flooring . . . Insulations . . . Roof Coatings and Cements
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THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

at capacity with backlogs the heaviest in years. Tonnage on books is heavier now than on Dec. 1. Large orders for electrical cable are placed by the navy, one for close to $1,000,000 being widely distributed with several New England mills sharing heavily.

Pipe

Pipe Prices, Page 331

Pittsburgh — The situation remains unchanged, with demand heavy for standard pipe and mechanical tubing. Despite rising backlogs, pipe producers here indicate no immediate plans for expansion of basic production facilities. However, there are some rebuilding jobs and addition of minor equipment to eliminate bottlenecks scheduled for 1941.

Cleveland—A large maker of standard merchant pipe finds December shipments an all-time record, not only for December but any month. New business continues brisk and is well diversified. Demand for line pipe and casings are fair.

Boston — Construction requirements, mostly indirectly connected with defense, will maintain demand for merchant steel pipe for some weeks. However, meager improvement is noted in normal industrial buying, this outlet taking the usual volume for some weeks and tapered at the new year. Ship construction is a promising prospect for increased miscellaneous pipe and tubing requirements.

Birmingham, Ala.—Pipe output is at the improved schedule effective for the past few weeks. While bookings are not individually large, the aggregate is highly satisfactory.

Cast Pipe Placed

225 tons, various sizes, Fort Monroe, Va., to Lynchburg Foundry Co., Lynchburgh, Va.

Expansion for preparedness requires

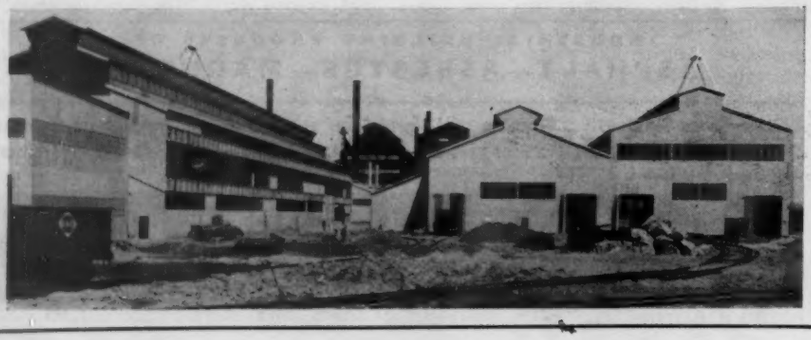
DEPENDABLE CONSTRUCTION.....

and there is no doubt that there will be a premium upon services of this nature shortly as production swings into high.

Every one knows that when industry is properly housed, production is easily kept to schedule. We are experts in the industrial construction field, but we don't make any wild claims; our success is based on nothing more mysterious than common sense and hard work applied by a close knit organization of experts. Illustrated above and below are a few of the buildings we constructed last year for the COPPERWELD STEEL CO. at Warren, Ohio. These buildings were built on time and up to specifications under the worst weather conditions in 80 years. *We are now called upon to construct additional buildings to meet the increasing demand for COPPERWELD'S "ARISTOLOY" Steels.* The Engineering Department, Construction Department and Management of this Company are ready to give you their personal services for the asking.

UHL CONSTRUCTION COMPANY

6001 BUTLER ST. PITTSBURGH, PA.



Rails, Cars

Track Material Prices, Page 331

Railroad buying at the beginning of the year is light, though an unusual number of locomotives were distributed in the final days of 1940. Considerable number of freight cars is still on inquiry for early placement and shops are busy on recent large orders.

Locomotives Placed

American Steel & Wire Co., one 660-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Atchison, Topeka & Santa Fe, two 360-horsepower diesel-electric switch engines, one going to Davenport Besler Corp., Davenport, Iowa, and one to the Whitcomb Locomotive Works, Rochelle, Ill.

Birmingham Southern, one 1000-horsepower diesel-electric switch engine, to the American Locomotive Co., New York.

Charles City Western, one 150-horsepower diesel-electric switch engine, to General Electric Co., Schenectady, N. Y.

Central of Georgia, one 1000-horsepower and one 660-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Inland Steel Co., one 660-horsepower diesel-electric switch engine, to the American Locomotive Co., New York.

Lone Star Cement Corp., one 175-horsepower diesel-electric switch engine, to Vulcan Iron Works, Reading, Pa.

Messena Terminal, one 660-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Newburgh & South Shore, two 660-horsepower diesel-electric switch engines, to American Locomotive Co., New York.

New York Central, 35 diesel-electric switch engines, twenty-six 600-horsepower units reported going to Electro-Motive Corp., La Grange, Ill., and nine 660-horsepower engines to American Locomotive Co. New York.

River Terminal, one 660-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Sanderson & Porter Co., two 300-horsepower diesel-electric switch engines, to General Electric Co., Schenectady, N. Y.

Seaboard Air Line, one 660-horsepower diesel-electric switch engine, to Amer-

ican Locomotive Co., New York.

South Buffalo, three 660-horsepower diesel-electric switch engines, to the American Locomotive Co., New York.

Texas Pacific-Missouri Pacific Terminal, one 660-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Union Pacific, fifteen 4-8-8-4 freight locomotives, to American Locomotive Co., New York.

Youngstown & Northern, one 1000-horsepower diesel-electric switch engine, to American Locomotive Co., New York.

Locomotives Pending

Navy, Sewall's Point, Va., one diesel locomotive and spares, Atlas Car & Mfg. Co., Cleveland, low.

Car Orders Placed

New York Central, 100 passenger cars reported placed, 45 to Pullman-Standard Car Mfg. Co., Chicago; 25 cars each to Pressed Steel Car Co., Pittsburgh, and American Car & Foundry Co., New York; five to Edward G. Budd Mfg. Co., Philadelphia.

Pittsburgh & Lake Erie, 1000 box cars, to unstated builder.

Shapes

Structural Shape Prices, Page 330

Pittsburgh — Tonnage continues to pour in, with construction, both industrial and governmental, in heavy volume for the defense program. There is also an unusual amount of highway construction, considering the season.

Cleveland — Inquiries and orders have slackened, but much work continues in prospect. The most regular outlet is the ordnance plant at Ravenna, O., bids for several buildings, aggregating a few thousand tons, having gone in early in the week. Ohio state bridges were both let and pending in other cases.

Boston—Structural steel contracts are the largest in several years, including 23,000 tons for extensions to shipbuilding facilities, Quincy, Mass., and a 13,500-ton bridge, New London-Groton, Conn. Bids also close this week on a 1288-ton bridge at Portland, Me., where a substantial tonnage will also be required for a shipbuilding yard.

Philadelphia—Structural inquiries are tapering further but heavy mill backlogs prevent immediate improvement in deliveries of plain material. Shipments on some sec-

Shape Awards Compared

	Tons
Week ended Jan. 4	**55,382**
Weed ended Dec. 28	**44,039**
Week ended Dec. 21	**34,296**
This week, 1940	**12,021**
Weekly average, 1941	**55,382**
Weekly average, 1940	**28,414**
Weekly average, Dec.	**31,516**
Total to date, 1940	**12,021**
Total to date, 1941	**55,382**

Includes awards of 100 tons or more.

Saves Time, Saves Money with CURTIS AIR HOISTS

As in hundreds of other industrial plants throughout the country, Foster Brothers Mfg. Company, St. Louis, is saving time and money through the use of Curtis Air Hoists.

A Curtis Air Hoist is used to raise and lower bed springs as they are dipped for painting. Production is stepped up, costs are lowered and a better paint job is assured through the use of this Curtis air-operated equipment.

Curtis Air Hoists have many advantages over other types of power hoists. They offer you:

- Low first cost and low operating cost.
- Smoother, faster, more accurate control of loads.
- Variable hoisting and lowering speeds.
- Minimum dead weight — available in pendant, bracketed or rope compounded types.
- Immunity to abuse or overloads—not harmed by atmospheric conditions.
- Fewer production interruptions for servicing.
- Can be operated by ordinary labor.
- Capacities up to 10 tons.

If you have any hoisting problem in connection with production in your plant, it is probable that Curtis Air Hoists will speed up your work and lower production costs at the same time. Their cost is low, the advantages great. For complete information on Curtis Air Hoists and their many industrial uses, send the coupon below for free booklet, "How Air Is Being Used in Your Industry."

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tions are deferred until May and June. Defense work predominates.

Shape Contracts Placed

23,000 tons, wet basin slip, extension facilities, Bethlehem Steel Co., shipbuilding division, Fore River yards, Quincy, Mass., to Bethlehem Steel Co., Bethlehem, Pa.

13,500 tons, bridge, Thames river, New London-Groton, Conn., to Harris Structural Steel Co., Plainfield, N. J.

4000 tons, elevated highway section, contract B-9, Brooklyn, to Bethlehem Steel Co., Bethlehem, Pa.; Turecamo Construction Co., New York, contractor.

3700 tons, hotel building, for Hotel Statler, Washington, to American Bridge Co., Pittsburgh.

1940 tons, armor plate machine shop, Midvale Co., Nicetown, Pa., to Bethlehem Steel Co., Bethlehem, Pa.

1100 tons, buildings 3 and 4, state hospital, Deer Park, N. Y., to American Bridge Co., Pittsburgh.

900 tons, state bridge 2071, Newberry, Ind., to American Bridge Co., Pittsburgh.

700 tons, buildings, Rheem Mfg. Co., Whiting, Ind., to Bethlehem Steel Co., Bethlehem, Pa.

600 tons, building, for Hamaba Realty Co., Maspeth, N. Y., to American Bridge Co., Pittsburgh.

550 tons, alterations to power house, for Consolidated Edison Co. of New York, New York, to American Bridge Co., Pittsburgh.

500 tons, hospital, Hartford, Conn., to Lehigh Structural Steel Co., Allentown, Pa., through Stone & Webster Engineering Corp., New York.

480 tons, drum shop, Badenhausen Corp., Cornwells Heights, Pa., to Belmont Iron Works, Philadelphia.

400 tons, state bridge, Leavittsburg, O., to Bethlehem Steel Co., Bethlehem, Pa., through Lombardo Bros. Construction Co., Cleveland.

370 tons, steel sheet piling, U. S. engineer, Milwaukee, to Inland Steel Co., Chicago.

370 tons, piling, inv. 1095-41-91, U. S. engineers, war department, Kenosha, Wis., to Inland Steel Co., Chicago.

350 tons, state bridge 2072, Newberry, Ind., to American Bridge Co., Pittsburgh.

350 tons, state procurement office, treasury department, Boston, Inv. A497; bids Dec. 10, to Phoenix Bridge Co., Phoenixville, Pa.

326 tons, storage and distribution addition, Crown Cork & Seal Co., Baltimore, to Bethlehem Steel Co., Bethlehem, Pa.; Consolidated Engineering Co., Baltimore, contractor.

300 tons, Williams Crossing, Franklin, Lebanon and Windham, Conn., for state, to American Bridge Co., Pittsburgh.

275 tons, extension, cold finishing mills, Ford Motor Co., Dearborn, Mich., to American Bridge Co., Pittsburgh.

216 tons, branch exchange for Pacific Telephone & Telegraph Co., Seattle, to Poole & McGonigle, Portland; Sound Construction & Engineering Co., Seattle, contractor.

203 tons, state bridge, contract 2075, Speed, Ind., to Central States Bridge & Structural Co., Indianapolis; bids Dec. 3, A. G. Ryan & Sons, Evansville, Ind., contractor.

200 tons, Baltimore & Ohio railroad bridge over state highway 4, Poast Town, O., to American Bridge Co., Pittsburgh.

190 tons, additions, Long Island Lighting Co., Glenwood, N. Y., to Lehigh Structural Steel Co., Allentown, Pa.

185 tons, state bridge, Kent, O., to Bethlehem Steel Co., Bethlehem, Pa., through National Construction Co., Cleveland.

183 tons, equipment repair building, Hill field, Ogden, Utah, to Steel Engineers Inc., Salt Lake City, through George A. Whitmeyer & Sons Co., Ogden, Utah; with 70 tons, bars, to Soule Steel Co., San Francisco.

160 tons, piling, bridges, inq. S 40, King county, Seattle, to Bethlehem Steel Co., Bethlehem, Pa.; Neukirk Brothers Co., contractor.

125 tons, shapes and bars, addition, building 15, Springfield, Mass., armory, structurals (86) to H. F. Elwell Iron Works, Springfield, and bars (36) to C. C. Lewis Co., Springfield; E. J. Pinney Co., Springfield, contractor.

110 tons, bridge, Adams county, Pennsylvania, to Bethlehem Steel Co., Bethlehem, Pa.

100 tons, shapes and bars, addition, Beverwyck Breweries Inc., Albany, N. Y., to Clausen Iron Co. Inc., Albany, and Strope Steel Co. Inc., Albany; Cassidy & Gallagher Co, Albany, contractor

Shape Contracts Pending

5000 tons, piling, bridge, Thames river, New London-Groton, Conn.; A. I. Savin Construction Co., Hartford, low.

2200 tons, inert storage buildings, Ravenna, O., for government.

1779 tons, viaduct, route S-3, section 1, Berry's Creek, Rutherford, N. J.; bids to New Jersey State Highway commission, Dec. 27, rejected; to be readvertised. Work also takes 175 tons, reinforcing bars; 250 tons, reinforcement steel trusses, and 64,606 linear feet, steel bearing piles.

Announcing

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Motor Driven Unit Grab . . .

. . . for Large Mill Operation

For many years Mansaver, Motor Driven Grabs of limited capacities have been produced and now a Mansaver Grab is available for the largest operaticns. Capacities of these large units are limited only by design.

Mansaver motor driven unit load grab operates on same adjustment principle as hand operated grab. Racks are welded to sliding members which carry load supporting angles. Racks are driven in opposite directions by a common pinion mounted on a slow speed vertical worm gear. The worm gears, one of which is at each end of the grab, are connected by flexible couplings to a main shaft. The main shaft is driven by a chain drive from the motor on which is mounted a friction clutch.

Electrical limit switches are unpractic-able with this type of grab because the limits are variable. A mechanical limit is supplied to prevent the rack from being disengaged from the pinicn. This type of grab can be supplied for any load carrying capacity.

A magnetic reversing controller equipped with thermal overload relay and forward and reverse push button, is supplied to be mounted by the customer or crane builder. Motcr is cf the hoist type to permit frequent starting and stopping. It is equipped with a magnetic brake to permit best contrcl of the opening and closing operation, and to assist in operating with minimum clearance. The size of the motor depends on the size of the grab varying from ¼ to ½ H.P.

We Also Build Coil Grabs

J. B. ENGINEERING SALES CO.

1743 Orange St. **New Haven, Conn.**

1680 tons, viaduct, route 3, section 1, New Jersey; new bids asked.

1620 tons, nine buildings, shell loading plant, Ravenna, O.; bids Dec. 30.

1500 tons, manufacturing building, Bullard Co., Bridgeport, Conn.

1200 tons, industrial buildings and barracks, Puget Sound navy yard and ammunition depot, Washington state; S. S. Mullen Inc. Seattle, and H. R. Olson, Tacoma, low.

800 tons, gate anchorages, Cherokee dam, Jefferson City, Tenn., Tennessee Valley authority

630 tons, Illinois highway bridges; bids Jan. 7.

500 tons, repairs to elevated lines Chicago Rapid Transit Co., Chicago.

500 tons, viaduct, Eleventh avenue, New York; bids Jan. 11 to New York Central railroad, New York.

489 tons, state highway bridge, section 411-F, Green and Jersey counties, Illinois; bids Jan. 7.

465 tons, bulb angle curbing, Brooklyn, N. Y., treasury department.

440 tons, state bridge, Mokelumne river, Sacramento county, California.

425 tons, state bridge, contract 2092, Lawrenceburg, Ind.

400 tons, state bridge, South Amana, Iowa.

350 tons, building alterations and additions, J. & F. Schroth Packing Co., Cincinnati.

300 tons, state bridge 2094, Marion, Ind.

265 tons, aircraft laboratory and shop building, Dayton, O., for government.

235 tons, warehouse, Sinclair Refining Co., E. Chicago, Ind.

230 tons, bridge, Fort Loudoun dam, near Lenoir City, Tenn.; bids Jan. 7, Tennessee Valley authority, Nashville.

225 tons, extension, Bancroft Hall, Annapolis, Md., U. S naval academy.

200 tons, bridge, Unadilla, N. Y., Otsego and Chenango counties, New York.

200 tons, Cramp Shipbuilding Co., Philadelphia.

185 tons, storehouse, Mellville, R. I., for navy.

170 tons, building, S. Boston, Mass., for navy.

160 tons, manufacturing building, Irvington Smelting & Refining Co., Irvington, N. J.

158 tons, highway project, route 4, section 42A, Cheesequake-Browntown, N. J.; Jannarone Contracting Co., Belleville, N. J., low; bids Dec. 27, State Highway commission, Trenton.

150 tons, Oregon state bridge, John Day river; Averill & Corbin, Portland, contractor.

140 tons, addition, Cincinnati & Suburban Bell Telephone Co., Hamilton, O

130 tons, gate track beams, Delhi, O., army engineers.

125 tons, monorail beams, ordnance plant, Ravenna, O., for government.

120 tons, state bridge, contract 2097, Frankfort, Ind.

120 tons, addition, Parish Pressed Steel Co., Reading, Pa.

115 tons, state bridge 2098, Cambria, Ind.

110 tons, state bridge 2096, Crawfordsville, Ind.

110 tons, cold storage building, project 37, Quonset Point, R. I., for navy.

105 tons, Great Northern railway undercrossing, Dean, Wash., for state.

105 tons, municipal hangar, Evansville, Ind.

100 tons, power house alterations, Jersey Central Power & Light Co., Sayreville, N. J.

100 tons, steel curbing, Hamilton avenue bridge, Brooklyn, N. Y., city of New York.

Perfect heavy melting steel.

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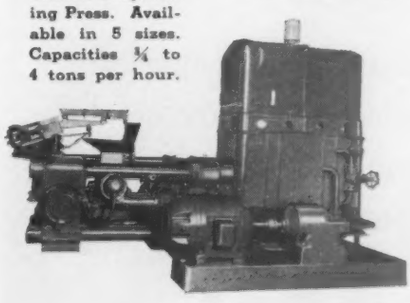
Borings *and* Turnings

Briquetting has proven to be the only economical method of reclaiming borings and turnings. In addition, a briquetting plant offers a complete solution to your chip handling problem by providing a continuous method of reducing bulky borings and turnings to a convenient size for conveying and storing. Briquettes make an ideal melting scrap either for use in your own plant or for resale at substantially increased market values. Write for full particulars.

Milwaukee Hydraulic Briquetting Press. Available in 5 sizes. Capacities ¾ to 4 tons per hour.



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3238 WEST PIERCE STREET • Cable Address "MILMOLDCO" • MILWAUKEE, WISCONSIN

Reinforcing

Reinforcing Bar Prices, Page 331

Chicago—Year ended with reinforcing steel interests moderately busy. Little new business, except miscellaneous jobs involving small tonnages, is up for bidding at the moment. Locally, plant expansions are the source of most new inquiries; in outlying territory several large tonnages for ordnance plants are maturing.

Boston — Sustained buying in small lots for prompt delivery has further lowered stocks with distributors finding increased difficulty in getting replacements. Prices are firmest in many months. Tonnage placed is down but volume of pending business is substantial with bridges and housing furnishing the larger lots.

New York—Bridge and highway requirements account for the bulk, estimated at several thousand tons. Small-lot purchases predominate but several larger contracts are to be closed this week. For WPA projects, the district procurement division is placing more orders, including one 750-ton lot on which delivery is asked piecemeal through June. Considerable tonnage is bought for Porto Rico, Panama and other outlying defense base sites. Prices are firm, more so outside than in New York area.

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Manganese and Alloy Steel
CASTINGS
FROM ½ TO 1000 POUNDS

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We are in position to manufacture specialties made of manganese and alloy steel castings and invite concerns to write us about their requirements.

DAMASCUS STEEL CASTING CO.
New Brighton, Pa.
(Pittsburgh District)

Reinforcing Steel Awards

3500 tons, factory, Curtiss Wright Corp., St. Charles, Mo., to Laclede Steel Co., St. Louis; H. B. Deal Co., St. Louis, contractor.

1000 tons, loading platforms, Elwood ordnance plant, Elwood, Ill., to Joseph T. Ryerson & Son Inc., Chicago; Sanderson & Porter, Joliet, Ill., contractors; bids Dec. 18.

800 tons, Hamilton avenue bridge, Gowanus canal, Brooklyn, N. Y., to Igoe Bros., Newark, N. J., through P. T. Cox Construction Co., New York.

545 tons, wire mesh, loading platforms, ordnance plant, Elwood, Ill., to Concrete Steel Co., Chicago; Sanderson & Porter, Joliet, Ill., contractors.

350 tons, storage and distribution addition, Crown Cork & Seal Co., Baltimore, to Dow-Weld Co., Philadelphia; Consolidated Engineering Co., Baltimore, contractor.

256 tons, including 156 tons steel sheet piling, concrete flood wall, section 3, U. S. engineer, Binghamton, N. Y., to Bethlehem Steel Co., Bethlehem, Pa.; L. B. Strandberg & Son, Chicago, contractor.

250 tons, St. Francis hospital, Peoria, Ill., to Bethlehem Steel Co., Bethlehem, Pa.; V. Jobst & Sons, Peoria, Ill., contractors.

200 tons, grade crossing elimination, RC-40-93, Westchester county, New York, to Carroll & McCready Co. Inc., Brooklyn, N. Y., through Arthur Gallow Inc., Bronx, N. Y.

174 tons, bent for Porto Rico, to Bethlehem Steel Export Co., New York; bids to U. S. engineer, New York, inv. 120; also 68 tons, ½-inch mild steel bars, inv. 121, to same fabricator; Dec. 30. Consolidated Expanded Metals Co., Long Island City, awarded 185,000 pounds expanded steel mesh at 3.55c, inv. 122, opening same date.

150 tons, buildings, Nos. 32 and 33, Willowbrook state hospital, Staten Island, N. Y., to Carroll & McCready Co. Inc., Brooklyn, N. Y., through Arthur Gallow Inc., Bronx, N. Y.

130 tons, grade crossing elimination, Berlin, N. J., to Bethlehem Steel Co., Bethlehem, Pa., through Eisenberg Construction Co., Camden, N. J.

111 tons, highway bridge, Lindberg boulevard, St. Louis county, Missouri, to Laclede Steel Co., St. Louis; Atkinson Windle Co., Chillicothe, Mo., contractor.

110 tons, cold storage building, McChord Field, Washington state, to Northwest Steel Rolling Mills, Seattle; Charles Dahlgren, Seattle, contractor.

100 tons, Jackson Park post office, Chicago, to Calumet Steel Co., Chicago.

Concrete Bars Compared

	Tons
Week ended Jan. 4	5,406
Week ended Dec. 28	1,174
Week ended Dec. 21	13,096
This week, 1940	12,149
Weekly average, 1941	5,406
Weekly average, 1940	9,661
Weekly average, Dec.	7,204
Total to date, 1940	12,149
Total to date, 1941	5,406

Includes awards of 100 tons or more.

100 tons, U. S. engineer, Memphis, Tenn., pro. 124, to Youngstown Sheet & Tube Co., Youngstown, O.

100 tons, naval hospital additions, Portsmouth, Va., to Truscon Steel Co., Youngstown, O.; R. R. Richards Co., contractor.

100 tons, bars and shapes, patients' building 62, veterans' hospital, Lake City, Fla., bars to Ceco Products Co., Birmingham, shapes to be awarded; J. M. Raymond Construction Co., Jacksonville, Fla., contractor.

Reinforcing Steel Pending

750 tons WPA requirements, procurement division, treasury department, New York, Ceco Steel Products Corp., New York, low.

500 tons, housing project, Cairo, Ill.; Henke Construction Co., Chicago, low.

335 tons, highway project 1163, Giles county, Virginia.

300 tons, Illinois State highway projects; bids Jan. 7.

300 tons, procurement division invitation QMSO 626-41-282, Brooklyn, N. Y.; bids Dec. 28.

200 tons, industrial buildings, Keyport torpedo station, Washington state; S. S. Mullen, Seattle, low.

175 tons, state highway, LaSalle county, Illinois; Midwestern Construction Co., Chicago, low.

175 tons, Martin Point bridge, Presumpscot river, Falmouth-Portland, Me.; bids Jan. 8, Maine State Highway commission, Augusta.

110 tons, bridge, Lackawanna avenue, Scranton, Pa.

100 tons, Norfolk & Western requisition 3237, Roanoke, Va.

100 tons, U. S. engineer, Providence, R. I.; bids in inv. 136, Dec. 30; also 120 tons, expanded steel mesh, inv. 135, same date.

Unstated tonnage, barracks and industrial structures, naval ammunition depot, Washington state; Nelse Mortensen & Co., Seattle, contractor.

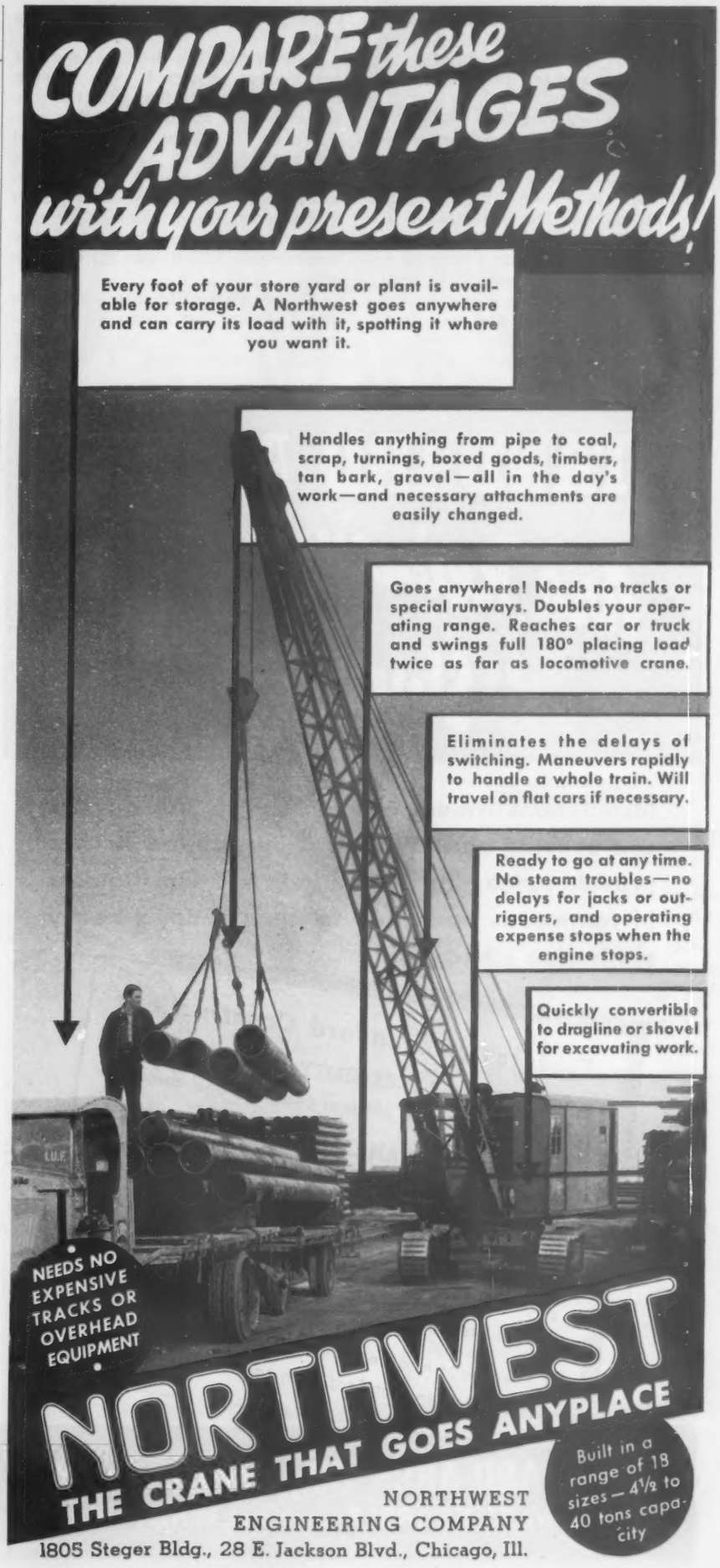
Pig Iron

Pig Iron Prices, Page 332

Pittsburgh—Although no formal announcement has been made here on iron prices for first quarter other than for silvery iron, it is expected that sales made after the first of the year and for delivery in second quarter will carry $1 increase, in line with prices in other districts.

Cleveland—Though sales are light, shipments in December have been equal to or somewhat superior to November. In cases where pig iron producers have not announced conformity to the higher price they have no iron to sell. Pig iron becomes increasingly scarce.

Chicago—Shipments of pig iron continue on a capacity basis, with prices still confused. Not all sellers have followed a leading maker in the advance of $1 a ton three weeks ago, although none is known to be accepting first-quarter tonnage at the old price. Sellers who have made no price announcement are declining to accept business until the price matter is settled. General feeling, however, is that the higher


COMPARE these ADVANTAGES with your present Methods!
Every foot of your store yard or plant is available for storage. A Northwest goes anywhere and can carry its load with it, spotting it where you want it.
Handles anything from pipe to coal, scrap, turnings, boxed goods, timbers, tan bark, gravel—all in the day's work—and necessary attachments are easily changed.
Goes anywhere! Needs no tracks or special runways. Doubles your operating range. Reaches car or truck and swings full 180° placing load twice as far as locomotive crane.
Eliminates the delays of switching. Maneuvers rapidly to handle a whole train. Will travel on flat cars if necessary.
Ready to go at any time. No steam troubles—no delays for jacks or outriggers, and operating expense stops when the engine stops.
Quickly convertible to dragline or shovel for excavating work.
NEEDS NO EXPENSIVE TRACKS OR OVERHEAD EQUIPMENT
NORTHWEST
THE CRANE THAT GOES ANYPLACE
Built in a range of 18 sizes—4½ to 40 tons capacity
NORTHWEST ENGINEERING COMPANY
1805 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill.

prices will be adopted ultimately. Coke demand is particularly strong. By-product ovens are running at full capacity and are unable to catch up on shipments.

Boston — Considerable unshipped pig iron, fourth quarter tonnage, is being shipped at the old prices, with the latter uncertain on first quarter business. However, little tonnage for this quarter has been taken, although substantial tonnage has been offered. Sellers continue to mark time but are supplying regular customers. The district furnace is still in blast and will probably continue for some weeks, although original plans indicated closing down at the first of the year.

New York—Pig iron sellers not previously reported as having opened books for first quarter continue to hold off, this applying particularly to New England and Buffalo producers. As consumers generally are covered on most requirements for this quarter they are not concerned. Meanwhile consumption is recovering from the holiday lull, which was lighter than usual.

Philadelphia—Pig iron consumers are pressing for shipment as the new year opens, some having sought postponement of deliveries during the inventory period. Buying is light as little additional iron is available and sellers generally out of the market except for regular customers. Iron being sold usually takes $1 above the market prevailing during most of the past year. Foundry operations tend upward.

Cincinnati—Needs of melters are fairly well covered for 60 to 90 days despite tardy opening of first quarter books and lack of formal announcement on prices. Considerable tonnage, especially northern, moved during December went into stocks, and the carryover and supplementary ordering will bridge the situation until the market is clarified.

St. Louis—Shipments of pig iron continue heavy and according to sellers of both northern and southern iron, total for December will be largest for the year, and heaviest for the month since 1937. Some buying is being done for first quarter at prices prevailing at delivery. Clarification of the price situation is still to be worked out, and no special effort is being made by users to augment stocks.

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STANDARD ARCH CO., Keedisville, Md.
Backed by 75 YEARS' Experience in Refractories

Scrap

Scrap Prices, Page 334

Pittsburgh — Month-end lull has settled over the local market pending the closing of railroad lists this week. Sales have been at slightly better levels on open-hearth grades. No. 1 is quoted $23.50 top, up 50 cents from last week. Other grades are proportionately higher.

Cincinnati—Prices are higher because of attempts of dealers to acquire tonnage. Supplies in many items are scarce. Market was tempered by holidays, but demand failed to weaken.

Chicago — Holiday season has served to reduce activity. Price tone continues strong. Principal grades are unchanged, with No. 1 heavy melting $20.50 to $21, although a few specialty grades are advancing as shortage develops. Mills may be satisfying needs by direct purchases. Jan. 2 was the closing date on several railroad lists.

Boston—Further advances on numerous grades of scrap for shipment to Pennsylvania and New England have been made, including steelmaking and foundry material. Barge shipments to the Baltimore district continue in good volume, brokers paying $17.25, barge. Demand is brisk with more scrap moving to the Pittsburgh district than usual. Cast grades are notably strong and heavy melting steel and stove plate for New England delivery have made an additional advance. Decline in export activ-

ity is more than made up by domestic demand and the latter influence on prices now predominates.

New York—With demand heavy and scrap coming out slowly prices on practically all grades are up 50 cents and in some instances more. In addition to taking substantial tonnages against old orders eastern steelworks are placing additional tonnage, while foundries also are getting in cast grades in good volume. Buying for export is slack but domestic demand more than offsets this.

Philadelphia — Steelmaking scrap is stronger at recently advanced prices, with cast grades up further. Available scrap supplies have been curtailed moderately by the holidays. Dealer stocks are light but little success is met in attempts to increase yard supplies. No. 1 heavy melting steel is firm at $21.50 top with none available at less.

Buffalo—Price upturns of 50 cents to $1 were posted on small but firm sales. Steelmaking grades jumped $1 as sales were made at $23 to $23.50, No. 1 heavy melting. Borings advanced 50 cents to $15 to $15.50. Dealers try to suppress any runaway market with an eye on Washington. Mild weather aids collection.

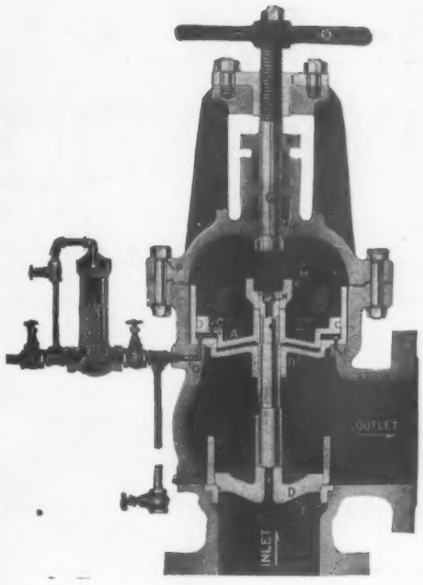
Detroit—On the eve of closing on a large number of lists of scrap in this area prices again have advanced 25 cents to $1 per ton. Supplies are tight and lists now up for bids show no great change from the previous month. Shortage of cast material is particularly in evidence, resulting in a scramble for such grades when they are thrown on the market. Heavy breakable is quoted $1.50 a ton higher.

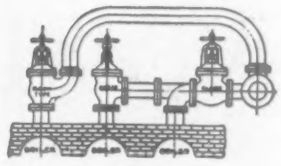
St. Louis—Purchase by an east side mill of 20,000 to 25,000 tons of No. 2 heavy melting steel served to enliven the year-end market for steel and wire scrap and incidentally to check the recent sharp upturn in scrap prices. The price paid was $18.25 f.o.b. consumer's plant, which is 25 cents per ton lower than the quotation for this grade early last week. Delivery over the next 60 days was specified and the business was divided among four dealers. Tone of the market generally was easier, with fractional reductions on a number of items, including cast and malleable grades and several steel specialties.

Birmingham, Ala. — The scrap market retains the strength of former weeks. Prices are unchanged, but some specifications are at a premium.

Seattle — The market is unchanged. Export stocks left by the embargo have been generally absorbed. Rolling mills, operating at capacity, are the principal buyers,

Golden Anderson
SPECIALTY
VALVES





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prices steady at $15 and $14 for No. 1 and No. 2, respectively. Foundry activity has increased and these plants are also taking a larger volume of scrap. Supplies are ample although unfavorable weather is restricting shipments from the interior.

Toronto, Ont.—Brisk activity continues in iron and steel scrap and special efforts are being made to stimulate supply. Steel mills and electric furnace operators are seeking larger quantities of heavy melting steel and other materials, while foundries and consumers of iron scrap are seeking cast and stove plate well in excess of the available supply.

Warehouse

Warehouse Prices, Page 333

Chicago—Steel warehouse sales continue to taper moderately and the volume for December is somewhat below November. However, the level is high and well above December of last year. Total business for 1940 is substantially ahead of 1939.

Cleveland—For the holiday period sales have been made in unprecedented volume, orders keeping up to the high level of the past two months. Staffs worked full days prior to the two holidays instead of usual half days because of pressure of demand. Chief problem is to replenish plates, which require at least 90 days.

Philadelphia — Warehouses have advanced hot-rolled sheets and strip 20 cents, effective Jan. 2, making sheets 3.55c, hoops 4.45c, bands 3.95c. The increase reflects tightening of the mill market to full 210c for hot-rolled sheets in recent weeks. December warehouse business was about on a par with November and is expected to maintain this pace in January.

Buffalo—Despite mild tapering in demand during the holiday season, distributors report aggregate December sales were unchanged to 10 per cent ahead of November.

Cincinnati—The holidays brought no letup in warehouse sales, reflecting a general industrial policy to hold shutdowns to a minimum. Stocks are spotty, with the greatest scarcity in structurals where speed demanded on shop additions has diverted tonnage from usual supply sources. Price lists are unchanged.

St. Louis—Recent activity in warehouse buying was maintained through December and indications point to even more demand following the holidays. Inquiry for structurals is heaviest and sheets, plates and merchant bars are also in the van of activity. Considering the broad diversity of demand, stocks at the end of the year were fairly well balanced.

Seattle — Effective Jan. 1, Seattle jobbing houses raised prices on plates, shapes and hot-rolled items $7 per ton base, advancing these items from 3.65c to 4.00c. This raises the local market to a parity with Portland where firmer prices have prevailed for the past year.

Tin Plate

Tin Plate Prices, Page 330

Pittsburgh — Operations remain unchanged at 48 per cent of capacity, representing almost entirely cold mill operations. Most of the major cold mill operations are at theoretical capacity, and there are few sources which expect resumption on hot mills to any appreciable amount during 1941. Outlook for tonnage in the domestic market is good since there are light carryovers in most canned foods. With economic conditions improving generally, demand for products in general line cans is certain to increase.

New York—Tin plate releases are much heavier than a fortnight ago with some producers now virtually booked for this quarter. Ex-

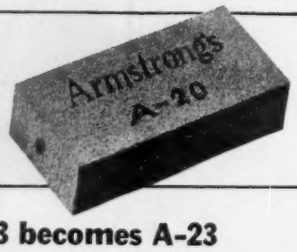
Announcing NEW NAMES
for the same familiar
ARMSTRONG'S BRICK

N-16 becomes A-16

The light-duty brick for use with temperatures up to 1500° F. on the hot face of the brick. Identified by its distinctive, red-brown color.

N-20 becomes A-20

The light-duty brick for use with temperatures up to 2000° F. on the hot face. Further identified by a *blue* color spot stamped on the end.

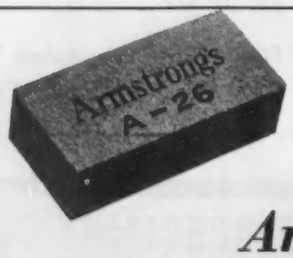


EF-23 becomes A-23

For heavy-duty use with temperatures up to 2300° F. on the hot face. Identified by a *green* color spot located on the end of the brick.

A-25 remains the same

For light-duty use with temperatures up to 2500° F. on the hot face. Identified by an *orange* spot easily seen on the end of the brick.



EF-26 becomes A-26

For heavy-duty use with temperatures up to 2600° F. on the hot face. Distinguished by a *red* color spot placed on the end of the brick.

Armstrong's
INSULATING FIRE BRICK
Armstrong Cork Company, Building Materials Division, 985 Concord Street, Lancaster, Pa.

port buying is light with action awaited by exporters on applications for navicerts. Portuguese tin plate stocks are said to be low and with fish canning season approaching exporters to that country are becoming concerned.

Steel in Europe

Foreign Steel Prices, Page 333

London — (*By Cable*) — Foundry pig iron supply in Great Britain is plentiful, basic is sufficient for needs and iron ore is adequate, supplemented by imports. Less demand is coming from civil engineering sources but shipbuilding plates and sections are in great demand. Output of special steels is absorbed by war production.

Tin plate exports to South America and the colonies continue active. The steel industry starts the new year in satisfactory condition.

Ferroalloys

Ferroalloy Prices, Page 332

New York—Ferromanganese sellers look for another increase in shipments in January, this estimate being predicated upon the likelihood of a still higher average rate of steel production. In fact, a further expansion is expected in the movement of most ferroalloys. Prices generally are unchanged, with ferromanganese holding at $120, duty paid, Atlantic and Gulf ports, and domestic spiegeleisen, 19 to 21 per cent, at $36, Palmerton, Pa.

Coke Oven By-Products

Coke By-Product Prices, Page 331

New York—Coke oven by-product prices are unchanged and for the most part firm. Those entering into industrial consumption, chemical, plastic and lacquer production are active. While output is high, bulk of material is moving into consumption without large accumulations. Prices on motor fuel benzol are easy, however. While some toluol is being consumed for munitions, the current rate is small compared with what may be expected with the completion of defense plants now under construction. Buying for household needs of naphthalene will not start for some weeks. Spot price on sulphate of ammonia is now $30 per ton bulk port and $1 less inland, producing ovens. Shipments to both the fertilizer and chemical trades are maintained.

■ United States buses last year operated 2,281,000,000 revenue miles, equivalent to more than 24 trips between earth and the sun.

Nonferrous Metals

New York — Trading in nonferrous metal markets was surprisingly active last week in view of the holiday and other factors. Producers still easily book their day's intakes and are concerned chiefly with production problems.

Copper—Sales for the full year totaled 1,111,179 tons, the largest annual figure ever recorded by Copper Institute Inc. Bookings are still in excess of production, resulting in a further reduction in refined stocks.

Lead—The market maintained its well-sold position at the 5.35-cent East St. Louis level. Supplies remain ample and with estimated 30,000 tons of foreign lead available to this market each month, control rests largely with importers and smelters who are sensitive to swings in demand.

Zinc—Due to holiday and year-end factors, galvanizing operations dropped to 68 per cent of capacity from the year's high of 84. Consumers continued to take all tonnages offered, however, at the 7.25c, East St. Louis, level for prime western.

Tin—Record sales in the Far

MAKE THIS A STRONG YEAR!

ONLY by knowing what it takes (for thirty years) and having the equipment to "take it" can steel castings be made to measure up fully to today's exacting requirements. That's the strong point about the STRONG foundry—it is so thoroughly and completely prepared to handle your steel castings from 30 ounces to 30,000 pounds. Know why—just ask for the facts, by mail or wire.

STRONG STEEL FOUNDRY COMPANY

STRONG

BUFFALO, N. Y.

TENSILE STRENGTH · ELONGATION

Eastern market were recorded with 2715 tons sold in five days. Purchases by the Metals Reserve Co. probably accounted for bulk of this business, although Japan and Russia may have bought substantial tonnages. Prices have remained unusually steady since mid-December at 50.10c for spot.

Antimony—Only routine caselot business was booked here on the basis of 14.00c, New York, for American spot. Chinese spot held at 16.50, duty paid at port of New York.

There was no price change in this market throughout the entire year.

Nonferrous Metal Prices

Dec.	Copper: Electro, del. Conn.	Copper: Lake, del. Midwest	Copper: Casting, refinery	Straits Tin, New York: Spot	Straits Tin, New York: Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
28	12.00	12.00	12.12½	50.10	50.05	5.50	5.35	7.25	17.00	14.00	35.00
30	12.00	12.00	12.12½	50.10	50.05	5.50	5.35	7.25	17.00	14.00	35.00
31	12.00	12.00	12.12½	50.10	50.05	5.50	5.35	7.25	17.00	14.00	35.00
Jan. 1	Holiday										
2	12.00	12.00	12.12½	50.10	50.05	5.50	5.35	7.25	17.00	14.00	35.00

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 12.00c Conn. copper

Sheets

Yellow brass (high)	19.48
Copper, hot rolled	20.87
Lead, cut to jobbers	8.75
Zinc, 100 lb. base	12.50

Tubes

High yellow brass	22.23
Seamless copper	21.37

Rods

High yellow brass	15.01
Copper, hot rolled	17.37

Anodes

Copper, untrimmed	18.12

Wire

Yellow brass (high)	19.73

OLD METALS

Nom. Dealers' Buying Prices

No. 1 Composition Red Brass

New York	8.00-8.25
Cleveland	8.62½-9.12½
Chicago	8.25-8.50
St. Louis	8.37½

Heavy Copper and Wire

New York, No. 1	9.62½-9.87½
Cleveland, No. 1	9.37½-9.87½
Chicago, No. 1	9.62½-9.87½
St. Louis	9.37½-9.50

Composition Brass Turnings

New York	7.62½-7.87½

Light Copper

New York	7.62½-7.87½
Cleveland	7.37½-7.87½
Chicago	7.62½-7.87½
St. Louis	7.37½-7.50

Light Brass

Cleveland	4.12½-4.37½
Chicago	5.50-5.75
St. Louis	4.87½

Lead

New York	4.60-4.70
Cleveland	4.00-4.25
Chicago	4.50-5.00
St. Louis	4.00-4.25

Zinc

New York	5.25-5.50
Cleveland	3.25-3.50
St. Louis	3.50-3.75

Aluminum

Mis., cast, Cleveland	9.25-9.50
Borings, Cleveland	6.50
Clips, soft, Cleveland	14.25
Misc. cast, St. Louis	8.00-8.50

SECONDARY METALS

Brass ingot, 85-5-5-5, less carloads	13.25
Standard No. 12 aluminum	15.25-16.00

COPPER & BRONZE

CASTINGS

OF HIGHEST QUALITY

BLAST FURNACE

Copper Standard Tuyeres
Copper Patented Tuyeres
Copper Bosh Plates
Copper Mantle Plates
Copper Cinder Notches
Copper Valves and Seats

ELECTRIC FURNACE

COPPER Electrode Holders
BRONZE Electrode Holders
WEDGES
Finished complete

ROLLING MILL

Hot and Cold Mill Bearings
Heavy Bushings
Screw Boxes, Housing Nuts
Machinery Bronze

Lawrence Heavy Duty Closed Bottom Tuyere Cocks.
Lawrence Heavy Duty Furnace Unions: Ball Unions

LAWRENCE COPPER & BRONZE
PITTSBURGH, PA.

Office:
Bessemer Building
Atlantic 6963

Plant:
Zelienople, Pa.
Zelienople 216

Offers Service to Steel Casting Buyers

■ A complete service for the production of electric steel castings, including designing, pattern making, annealing and rough finishing, is now offered by Key Co., East St. Louis, Ill. The company also is equipped with a modern machine shop for complete finishing of either special or production runs of castings, should the buyer's requirements demand full finishing operations.

Steelworks Rate Rebounds, 95½

■ STEELWORKS operations last week regained practically all the loss of the previous week, the rate rising 15½ points to 95½ per cent. Eleven districts showed increases substantially equal to the declines a week earlier. Repairs caused one district to recede slightly. A year ago the rate was 86½ per cent; two years ago, 51½ per cent.

Chicago—Increased 20 points to 99½ per cent. Only in three weeks previously in all history has this rate been equaled or excelled, all in the past seven weeks. The all-time high was 100 per cent in the week of Nov. 18.

Buffalo—Up 15 points to 93 per cent, with 40 of the 43 open hearths in production.

Birmingham, Ala.—With all open hearths active the rate regained 16 points to 100 per cent.

Cincinnati—Rebounded to 87 per cent, a gain of 14 points from the preceding week.

New England—Furnace repairs, largely at one works, caused ingot production to decline 5 points to 85 per cent. Sharp rise is expected this week.

St. Louis—Rise of 8 points to 87½ per cent followed the holiday week, with the same schedule expected this week.

Cleveland—Resumption of production after the holiday brought an increase of 12 points to 84 per cent.

Pittsburgh—Rose 20½ points to 95½ per cent, with the same or a higher rate probable this week.

Wheeling—Regained 20 points to 96 per cent, slightly below the level of early December.

Youngstown, O.—Advanced 14 points to 92 per cent, one point under the highest mark in 1940. Republic Steel Corp. took off one open hearth for repair. Schedule for this week is for the same rate or possibly a slight increase.

Central eastern seaboard—Production last week snapped back to 95 per cent, with indications of a sustained rate for many weeks.

Detroit—Resumed at 90 per cent after the holiday, an increase of 14 points from the preceding week.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended Jan. 4	Change	Same week 1940	Same week 1939
Pittsburgh	95.5	+20.5	89	44
Chicago	99.5	+20	90.5	53
Eastern Pa.	95	+13	82	34
Youngstown	92	+14	85	50
Wheeling	96	+20	89	64
Cleveland	84	+12	85	54
Buffalo	93	+15	67	44
Birmingham	100	+16	94	77
New England	85	− 5	83	70
Cincinnati	87	+14	91	72
St. Louis	87.5	+ 8	78.5	45.5
Detroit	90	+14	90	91
Average	95.5	+15.5	86.5	51.5

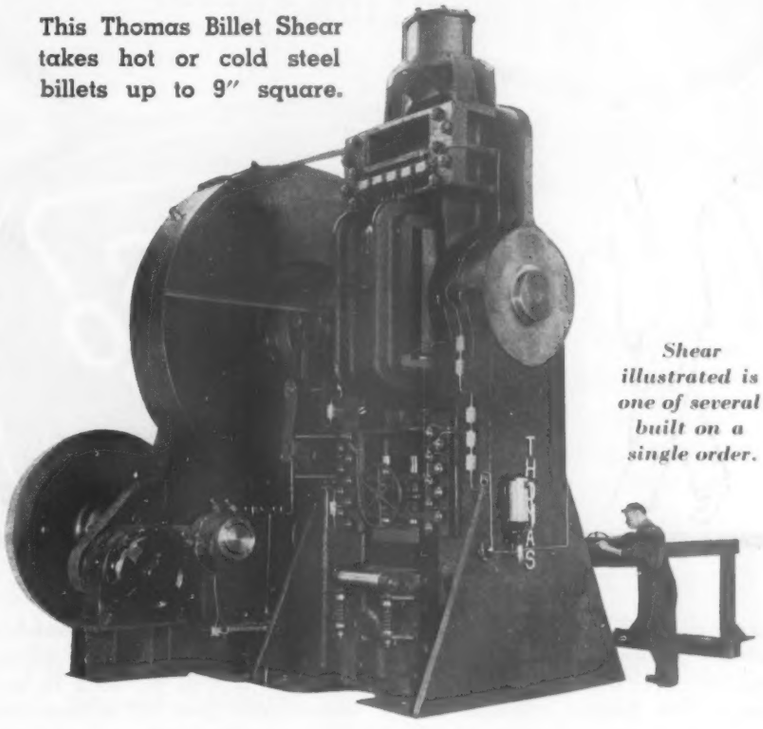
1940 Structural Orders Total 1,700,000 Tons

■ Orders booked by the fabricated structural steel industry during 1940 probably did not exceed 1,700,000 tons despite the recent increase in business resulting from the national defense program, according to the American Institute of Steel Construction, New York. This compares with 1,305,049 tons booked in 1939; 3,597,825 in 1929.

Capacity of the industry has changed but little since 1929. Some shops have been closed and others have been absorbed, but the shops remaining have, in many instances, extended their capacities in order to effect economies in production and for other reasons. Therefore, business booked in 1940 did not tax physical capacity or man-power.

Thomas Built SHEARS
For All Shearing Problems

This Thomas Billet Shear takes hot or cold steel billets up to 9″ square.



Shear illustrated is one of several built on a single order.

Thomas built shears answer the demand for fast, dependable shearing. The increase in use of higher tensile steels and aluminum finds Thomas Shears well qualified for any requirements.

SPECIAL SHEARS . . . PLATE SHEARS . . . SHEARS FOR ALL PURPOSES

THOMAS
MACHINE MANUFACTURING COMPANY

Manufacturers of THOMAS (the leading) SPACING MACHINES

PITTSBURGH, PA.

Offices Also at Philadelphia, Pa.

Year's End Brings Wage Rate Increases to Auto Workers

DETROIT

■ CHIEF news in the automobile industry last week was wage increases at Packard, Bohn Aluminum, Motor Products and some others, following general increases granted by Chrysler and Hudson.

Ford Motor Co., now feeling the brunt of the UAW-CIO organizational effort, has quietly made some sweeping increases in wage rates but has said nothing publicly about them. Company spokesmen characterized the revisions as regular "quarterly readjustments."

Automobile wage increases usually are embodied in new union contracts and naturally UAW-CIO spokesmen take most of the credit for having won them. Unusual feature of the Packard contract was the provision for employes to share in company profits up to 10 per cent of earnings until July 1, with guaranteed minimum payment of $15. The management offered to pay this bonus immediately if the union would advance $45,000, but the offer was rejected.

The UAW-CIO has petitioned the NLRB for an employe election in the Lincoln division of Ford to determine whether the union shall be appointed bargaining agent for 3800 men in the plant. This appears to be the first definite action in the campaign to organize Ford, other than distribution of literature to Ford employes.

Meanwhile Ford has received from the government a grant of $21,000,000 for erection of an aircraft engine plant, scheduled to be in operation in April. Steelwork for the building now is nearing completion. Advices from Washington indicate that magnesium castings requirements will be supplied by a new foundry being readied for operation in the Ford foundry division, capable of furnishing 110,000 pounds of castings a month, 70,000 of which will be needed by Ford, the balance for use outside. The foundry will be on two floors with 100,000 square feet of floor space.

On the first floor, cores will be made and sent to the second floor where a system of four continuous-type conveyors will carry molds to pouring stations opposite 17 gas-fired melting crucibles with total capacity of 10,520 pounds.

After castings are poured and

Automobile Production

Passenger Cars and Trucks—United States and Canada

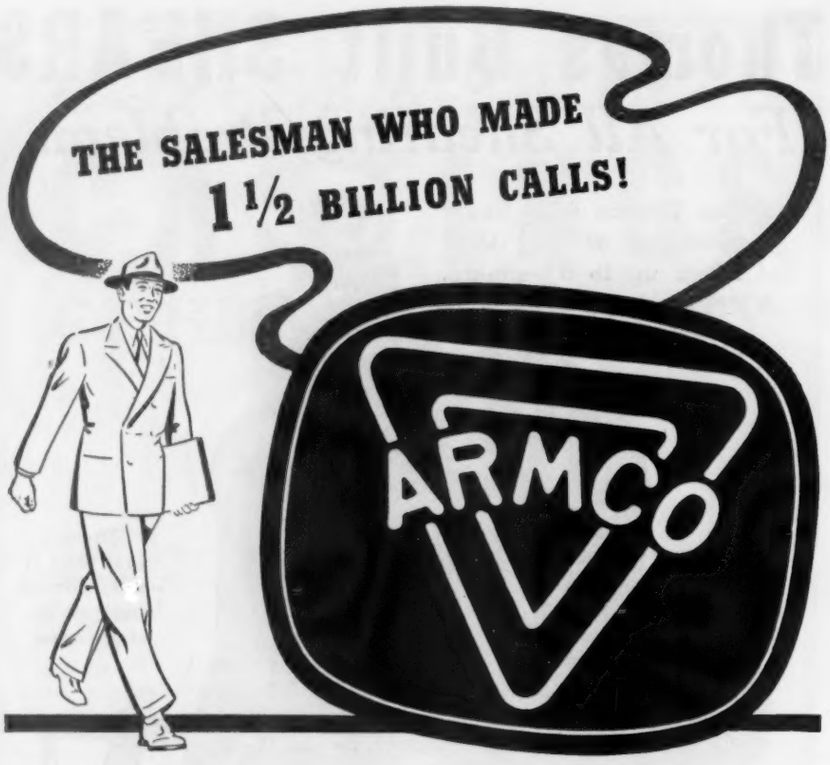
By Department of Commerce

	1938	1939	1940
Jan.	226,952	356,692	449,492
Feb.	202,597	317,520	422,225
March	238,447	389,495	440,232
April	237,929	354,266	452,433
May	210,174	313,248	412,492
June	189,402	324,253	362,566
July	150,450	218,494	246,171
Aug.	96,946	103,343	89,866
Sept.	89,623	192,678	284,583
Oct.	215,286	324,688	514,374
Nov.	390,405	368,541	510,973
11 mos.	2,248,211	3,263,600	4,185,407
Dec.	406,960	469,120	.....
Year	2,655,171	3,732,608	.....

Estimated by Ward's Reports

Week ended:	1940	1939†
Dec. 7	125,690	115,488
Dec. 14	125,625	118,405
Dec. 21	125,350	117,705
Dec. 28	82,545	89,365
Jan. 4	76,690	87,510

†Comparable week.



Incredible? Not for this well known printed symbol of special-quality sheet metals. In the past 26 years, the ARMCO triangle trademark has appeared *1½ billion times* in national and trade magazines. Consumers have been persuaded to look for this mark as assurance of finest basic metal quality in the products they buy.

Hundreds of manufacturers have shown many millions of ARMCO labels on their products in these 26 years. Dealers and consumers recognize ARMCO-identified products and buy with complete confidence.

This year the ARMCO triangle trademark will be seen in magazines *more than 100 million times!* Think of the influence this could have on *your* sales.

Consider putting the ARMCO label on every one of your metal products this year. This way you cash in on stored-up sales power. Best of all, it costs you nothing for the services of this able "silent salesman." Ask us about it. The American Rolling Mill Company, 210 Curtis St., Middletown, Ohio.

ARMCO

THE ARMCO LABEL ...26 YEARS OLD

shaken out they will be cleaned and heat treated in a 150-foot annealing furnace for 40 hours. About 350 men will be employed in the new foundry.

J. J. Griffin, secretary of the Society of Tool and Die Craftsmen, a labor organization, is sending to Washington copies of a proposal to facilitate distribution of tool and die work among Detroit shops. It involves direct placement of contracts in qualified shops without the necessity for competitive bids, then the supervision of the work in a group of shops in one "district" by a government engineer-inspector. The shops would be paid on a basis of $3 per hour, plus material, and would receive 10 per cent of the job price with award of the contract, 50 per cent more when the job was half done and the balance when the work was completed.

The proposal appears to have some merit for small shops who find government work involves a maze of red tape and long delays in awarding contracts, as well as no reimbursement until a job is completed and approved.

"Many Unemployed"

Griffin points out that there are many unemployed tool and die men in the Detroit district now, contrary to popular impressions, and a speedy correlation and expediting of government defense contracts would help to put these men back to work.

With all the dire warnings of how critical the bottleneck in machining operations is proving to be in the defense program, it was strange to read in a recent edition of a Detroit paper (and others) an advertisement soliciting machine work for boring mills, radial drills, turret lathes, engine lathes, drill presses and milling machines. The equipment is of the latest type, in a new building, and is available at once.

Scrap Standards Reissued

■ Printed copies of Simplified Practice Recommendation R58-36, Classification of Iron and Steel Scrap, are again available at the office of the suprintendent of documents, government printing office, Washington, according to the national bureau of standards. Price is 5 cents per copy.

Recommendation specifies classes of scrap for blast, basic open-hearth, acid open-hearth, and electric furnaces for gray iron foundry practice, bessemer converters, and for miscellaneous scrap. It includes a contract form for purchase of scrap. First effective July 1, 1926, the classification was revised in 1928 and reaffirmed in that form in 1932 and 1935. Revision of 1936 was reaffirmed in January, 1940.

9000 Added to Steel Payrolls in November

■ Approximately 9000 employes were added to the steel industry's payrolls during November, bringing employment to a total of 577,000, according to figures compiled by the American Iron and Steel institute.

During October, steel employment averaged 568,000, while 561,000 were employed in the month of November, 1939.

Reflecting the short month and the November holidays, total steel payrolls of $87,921,000 during the month were slightly below October payrolls of $90,768,000.

In November a year ago steel industry payrolls aggregated $86,682,000.

Wage-earning employes in the steel industry earned an average of 86.2 cents per hour in November, compared with 85.6 cents in October and 84.7 cents in November, 1939.

An average of 38.2 hours per week was worked by wage earners in November, as against 39.4 hours per week in October and 39.5 hours worked per week in November of last year.

MUNITION FURNACES

- - - QUICK DELIVERY - - -

Rotary Hearth Forging Furnaces

Batch Type Forging Furnaces

Quench and Draw Units (Complete)

Cartridge Heat Treating Units (Direct Fired and Convection Type)

Continuous End Heating Furnaces (Nosing Furnaces)

Vertical Heat Treating Pits for Gun Tubes (Light and Heavy)

Low Pressure Air Atomizing Proportioning Oil Burners
Long Luminous Flame Gas Burners

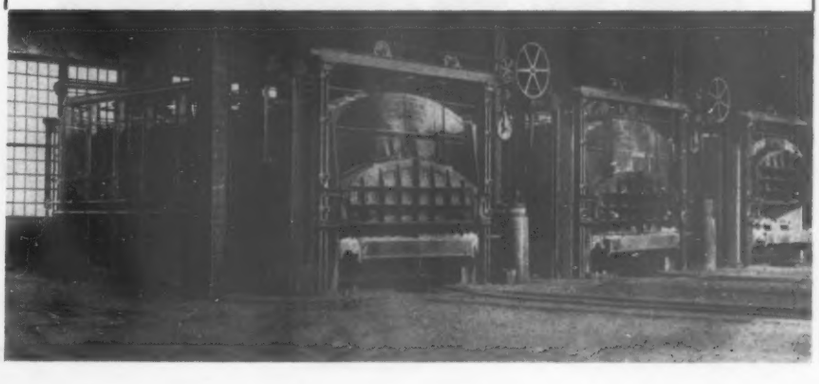
Let Us Quote on Your Requirements

TATE-JONES & CO., Inc., Leetsdale, Pa.

FURNACE ENGINEERS AND MANUFACTURERS SINCE 1898

We also manufacture the following types of furnaces and furnace accessories:
Nozzle Mix Premix Burners—Proportioning Burners—Recirculating Units—Car Type Quench & Draw Furnaces—Gas Carburizing Furnaces—All Types of High & Low Pressure Oil Burners

ARMOR PLATE FURNACES



MEN of INDUSTRY

■ RALPH H. NORTON, the past 18 years president, Acme Steel Co., Chicago, has been elected chairman of the board. He succeeds James E. MacMurray, who has resigned. Although inactive in the management the past few years, Mr. MacMurray has maintained his interest in the organization which he started and will continue as a member of the board of directors.

Charles S. Traer succeeds Mr. Norton as president. He formerly was vice president in charge of production. He joined the Acme organization in 1915.

Frederick C. Gifford, first vice president and director of sales, has retired from active duty but will continue as a director. Mr. Gifford has had charge of the distribution of Acme products since 1918. Carl J. Sharp, vice president, has succeeded Mr. Gifford as director of sales. Chester M. MacChesney has become first vice president and secretary, while Thornton A. Rand is

Ralph H. Norton

Charles S. Traer

C. M. MacChesney

INDUSTRIAL SPRINGS

STEEL, STAINLESS STEEL, BRASS OR PHOSPHOR BRONZE, FINISHED PLAIN, GALVANIZED, COPPERED, NICKELED OR JAPANNED

Springs came into existence as motive power (as in watches) or as a means of absorbing shocks. The development of springs as shock absorbers came with the development of steel; even a century ago leaf springs and coil springs for industrial use were still novel. Because we have been making industrial springs for over half a century, we feel that our experience rates us as authorities. What pleases us most, however, is the fact that our clients rely upon our reputation, and take our uniformly good springs as a matter of course.

AMERICAN
SPIRAL SPRING & MANUFACTURING COMPANY
5540 Harrison St., Pittsburgh, Pennsylvania

FOR EVERY PURPOSE INVOLVING SPRINGS, IT PAYS TO CONSULT US

Carl J. Sharp

now treasurer and assistant secretary.

♦

H. C. Strom has been elected vice president, Pittsburgh Steamship Co., Cleveland, subsidiary of United States Steel Corp., and D. C. Potts has been appointed manager of traffic, succeeding Mr. Strom. Both men have had long experience in Great Lakes shipping and are widely known in transportation circles.

H. C. Strom

D. C. Potts

Mr. Strom joined Pittsburgh Steamship in 1907; in 1910 was transferred to Duluth as assistant agent. For three years he acted as agent at Duluth for Interlake Steamship Co. and in 1916 returned to Pittsburgh Steamship as agent at Duluth. In 1924 he was transferred to Cleveland as manager of traffic.

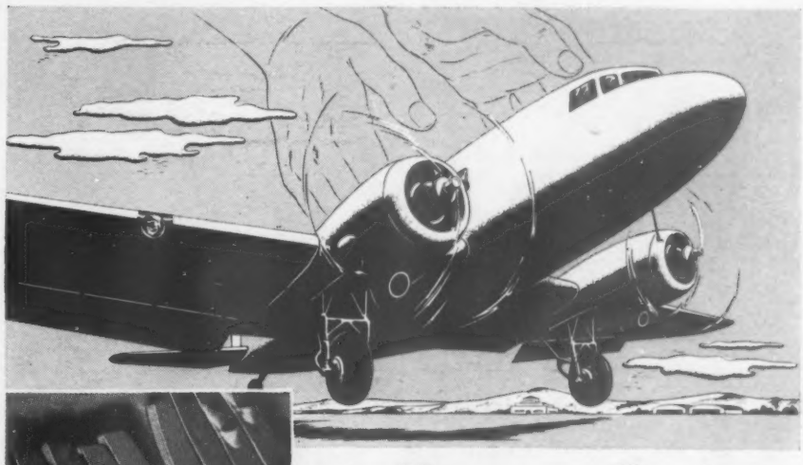
Mr. Potts, since 1933 chief dispatcher, has been associated with the company since 1913, serving in the accounting, furnace ore and traffic departments.

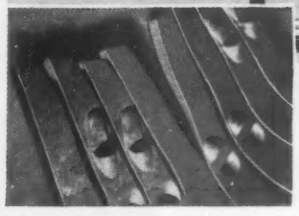
♦

W. D. Murphy, advertising manager, Sloan Valve Co., and vice president, National Industrial Advertisers association, joined Reincke-Ellis-Younggreen & Finn, advertising agency, Chicago, Jan. 1, in an executive capacity.

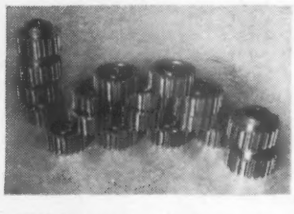
♦

H. W. Warley, vice president and general manager of the Calmar Steamship Corp., and the Ore Steamship Corp., affiliates of the Bethlehem Steel Corp., has been elected president of the Calmar line. Other appointments in the Calmar organization were: E. J. Karr, formerly traffic manager, as a vice president; H. Denzel, vice president and auditor; W. H. E. Usher, vice president; M. R. Kreidler, secretary and treas-





FORMING DIES...where AMPCO METAL'S hardness, its resistance to piening, wear and impact result in exceptional accuracy and long life.



GEARS...the toughness and wear resistance typical of AMPCO METAL recommends it for all types of gears, ranging from a fraction of a pound to hundreds of pounds each.

BEARINGS...AMPCO METAL is probably more widely used for bearing service than any other bronze. It is noted for its stubborn resistance to wear, "squashing out" and shock loads.

Like *Protective Hands* for a

SAFE LANDING!

A critical moment—as plane and ground meet. If vagaries of wind and timing make the meeting a rough one, the landing gear must safely absorb severe impact. At points of greatest stress and shock in the landing gear of plane after plane, AMPCO METAL is used...undeniable proof of the greater strength and longer wearing qualities of this dependable bronze.

SPECIFIED *for the* "TOUGH" JOBS

In other industries, as in aviation, you'll find AMPCO METAL widely used wherever exceptional durability and resistance to impact, fatigue, wear and corrosion are required. It enjoys a unique reputation as "the metal that makes good when all others fail."

Have You a Problem of "Metal Failure"?

Maybe AMPCO METAL can master a troublesome job for you. It's made in many grades and forms. Tell our engineering staff what you're up against, and they'll be glad to supply complete data and recommendations.

There's no obligation. Write

AMPCO METAL, INC., Dept. S-16, Milwaukee, Wis.

urer; C. J. Rashleigh, assistant secretary and assistant treasurer.

♦

William P. Witherow, president, Blaw-Knox Co., Pittsburgh, has accepted the 1941 chairmanship, committee on national defense and industrial mobilization, National Association of Manufacturers.

♦

John C. Hopkins has become associated with William M. Bailey Co., Pittsburgh, in a sales capacity, in the Middle West and South, maintaining headquarters in Cleveland. Mr. Hopkins has had wide experience as a blast furnace operator and in various executive positions in the steel industry.

♦

Chester D. Tripp has been elected president, Grip Nut Co. He succeeds John H. Sharp, resigned. Ernest H. Weigman, a member of the sales organization the past ten years, has been appointed sales manager.

The sales and general offices of the company have been moved from South Whitley, Ind., to 310 South Michigan avenue, Chicago.

♦

L. C. Allenbrand has been promoted to manager, sales development division, Caterpillar Tractor Co., Peoria, Ill., to fill the vacancy left by appointment of G. E. Spain to general sales manager. Mr. Allenbrand joined Caterpillar Tractor in April, 1931, as special representative in the general sales department, and since 1934 has served as assistant manager, sales training division.

♦

M. B. Gentry, mining engineer, has been elected a vice president, Freeport Sulphur Co., New York.

M. B. Gentry

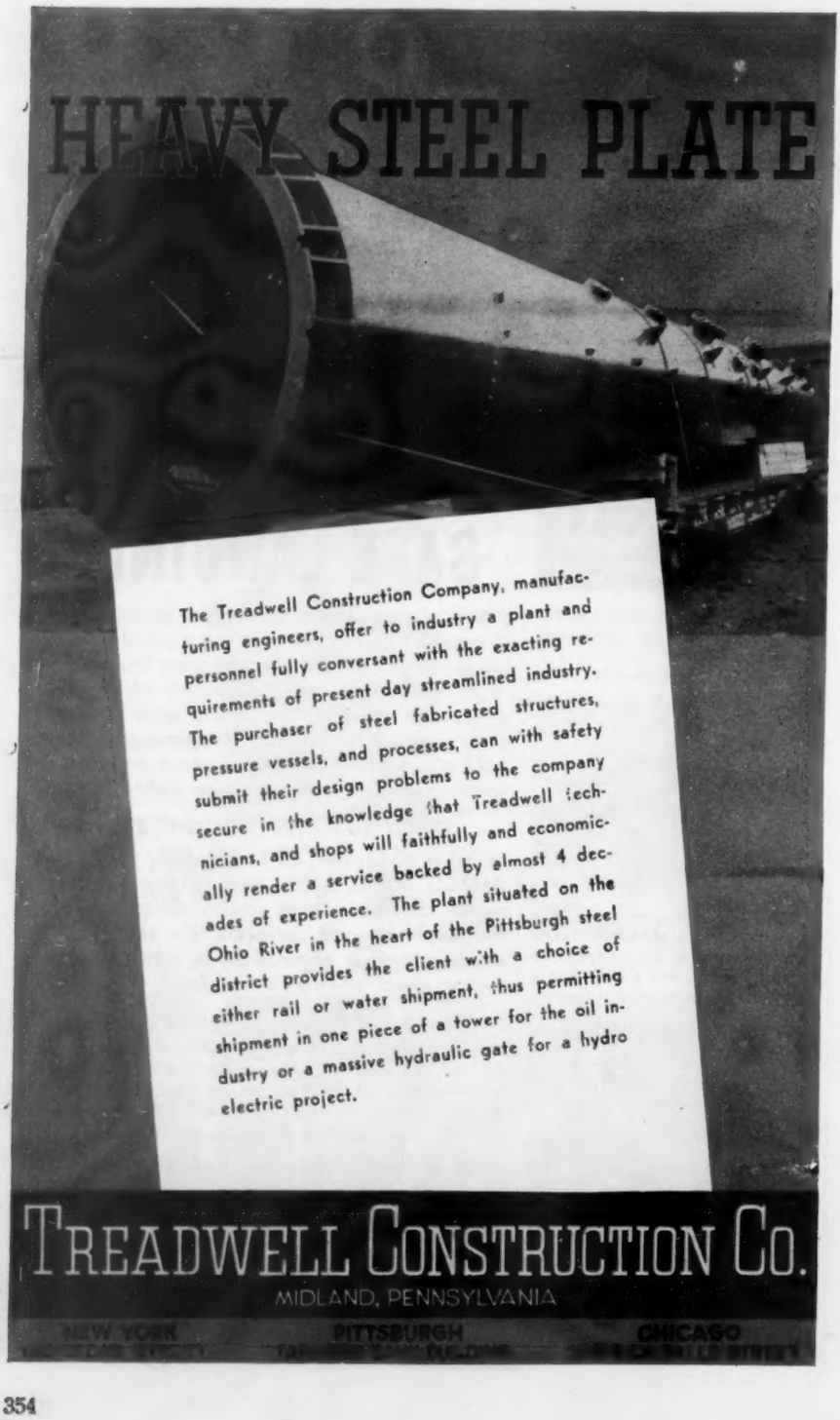
He joined Freeport in 1935 as assistant to the president. He has been in charge of foreign sulphur sales and of sales of the Cuban-American Manganese Corp., a subsidiary.

♦

Joseph B. Ennis has been appointed senior vice president, American Locomotive Co., New York, and has been succeeded as vice president in charge of engineering, development and research by James E. Daven-

Michael F. Yarotsky

Who has been named superintendent of steel production, South works, Carnegie-Illinois Steel Corp., as noted in STEEL, Dec. 30, page 19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J. B. Ennis

port, heretofore assistant vice president of engineering.

Mr. Ennis began as a tracer in the drafting room of Rogers Locomotive Works. From 1901 to 1902 he served as elevation draftsman, Cooke works of American Locomotive, and then was transferred to New York in charge of designs and

J. E. Davenport

calculation specifications for locomotives. Subsequently he served as assistant to mechanical engineer, designing engineer, chief mechanical engineer, and in 1917 was named vice president in charge of engineering.

Mr. Davenport entered railway service in 1909 as a special apprentice at the West Albany shops of New York Central and until 1940, when he joined American Locomotive, his entire career was with that road.

♦

Jacob J. Phifer has been appointed assistant general superintendent, Fairfield steel works, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. Marion G. Crosthwait has been named to succeed Mr. Phifer as superintendent of Fairfield wire works. Mr. Crosthwait formerly was assistant superintendent of wire works.

♦

Harry L. Erlicher, purchasing agent, General Electric Co. since 1931, and an employe of the company 40 years, has been elected a vice president. He will continue in charge of purchasing activities.

♦

Augustin L. J. Queneau, Peapack, N. J., metallurgist for United States Steel Corp. subsidiaries since 1925, and a member of the 1901 class, Columbia university school of engineering, New York, has been selected to receive the Columbia Lion award by the Columbia Alumni club, Essex county, N. J. Mr. Queneau, whose 38 years as metallurgist and engineer include professional services in Belgium, England and France during the first World war, wins the award as "an outstanding citizen of New Jersey who has brought honor to Columbia through conspicuous world service and noteworthy achievement."

♦

H. B. McKinley, assistant treasurer, Caterpillar Tractor Co., Peoria, Ill., retired Dec. 31. He will make his home in Florida.

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Died:

■ COL. FRANKLIN B. RICHARDS, 78, associated with M. A. Hanna Co. and Hanna Furnace Co., Cleveland, from 1893 until his retirement in January, 1930, at his home in Cambridge, Mass., Dec. 30.

Born in North Andover, Mass., Nov. 12, 1862, Colonel Richards attended Massachusetts Institute of Technology. He began his career in 1884 as a chemist with the Stafford Mining Co., North Stafford, Vt., subsequently joining Brier Hill Iron & Coal Co., Youngstown, O., and Tod, Stambaugh & Co., Cleveland. His first position with the Hanna organization was that of manager of the ore department. In succeeding years Colonel Richards rose to the chairmanship of Hanna Furnace and to a vice presidency in the parent company. In addition to his Hanna affiliations, he had been vice president and a director, Detroit Iron & Steel Co.; treasurer and a director, United Iron & Steel Co., and a director, Pennsylvania Iron & Coal Co., Bonner Iron & Coke Co., Pittsburgh Ore Co., Cuyahoga Coal Co. and Milwaukee Coke & Gas Co. He was president of the Lake Superior Iron Ore association for a number of years.

♦

C. Harold Wills, 62, chief metallurgist for Chrysler Corp., Detroit, in that city, Dec. 30. Starting at the age of 18 in the drafting room of the Boyer Machine Co., Detroit, he later became associated with Henry Ford. He left the Ford company in 1919 and built a plant at Marysville, Mich., where he manufactured Wills-Sainte Claire automobiles.

During the World war, he made Liberty engines and devised a method for manufacturing steel cylinders at about one-tenth the cost originally contemplated. In the field of alloy steels Mr. Wills was a pioneer. He is reported to have developed the first vanadium steel for commercial purposes, and later engineered a series of molybdenum steels for motor car applications known today as Amola steels and used widely in Chrysler-built products.

He was active in many other phases of metallurgy, such as the direct reduction of iron ore, and in this field supervised operation of an experimental plant at Lorain, O., for the United States Steel Corp.

♦

Henry W. Penton, 77, retired consulting marine engineer, and brother of the late John A. Penton, founder and board chairman of the Penton Publishing Co., Cleveland, Dec. 30 in St. Petersburg, Fla.

Born in Paris, Ont., he became a machinist's apprentice in Fort Gratiot, Mich., and Detroit. He was chief engineer for several Detroit marine companies, and later a chief engineer on the Great Lakes.

Returning to shore employment as a marine construction superintendent, he was employed by the Chicago Shipbuilding Co. and later by the Great Lakes Engineering Works in Detroit.

From 1909 to 1911 he was associate editor of *Marine Review* and also engineering editor of *Iron Trade Review*, now STEEL. In 1917 Mr. Penton was named by the United States shipping board as manager for the Emergency Fleet Corp.'s district 9, taking over ship construction in the Great Lakes area.

In 1919 he resigned from his government post and returned to consulting work with offices in Cleveland. He was an honorary member, Society of Naval Architects and Engineers.

♦

Harry T. Gilbert, 67, who retired four years ago after being affiliated with the iron and steel industry as a sales executive many years, in Pass Christian, Miss., Dec. 27. Mr. Gilbert was general manager, Midland Steel Products Co., Cleveland, from October, 1931, to June, 1932,

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following which he became manager of sales, Chicago district, Illinois Steel Co., and in 1934 represented the Carnegie Steel Co. in that district.

Prior to becoming general manager of Midland Steel Products, Mr. Gilbert was special assistant to T. M. Girdler, chairman of Republic Steel Corp., and before that was vice president in charge of sales, Republic Iron & Steel Co., and executive vice president, Sharon Steel Hoop Co., Sharon, Pa.

♦

Fred W. Owens, 50, the past 15 years chief engineer, Calumet Steel Co., division Borg-Warner Corp., Chicago, in Chicago, Jan. 1.

♦

Stephen Birch, 68, chairman of the board, Kennecott Copper Corp., New York, and Braden Copper Co., and president, Alaska Steamship Co., Dec. 29, in New York.

♦

B. I. Weller, 63, president, Weller Metal Products Co., East Chicago, Ind., maker of sheet metal work for grain elevators, at his home in Highland, Ind., Dec. 27.

♦

Edward A. Tank, 49, tool supervisor, A. O. Smith Corp., Milwaukee, recently, at his home in that city.

♦

Carlyle S. Green, 41, vice president and director of purchasing, Greene Mfg. Co., Racine, Wis., in Racine, Dec. 23.

♦

Walter E. Kasten, 42, treasurer, O. F. Jordan Co., East Chicago, Ind., maker of railroad equipment, at his home in Hammond, Ind., Dec. 25.

Steel Castings Makers Report 1939 Decline

■ Employment, wages and production reported by manufacturers of steel castings in the census of manufactures for 1939 showed considerable decreases, compared with the 1937 census. Figures cover establishments primarily engaged in manufacture of steel castings but does not cover foundry departments of steelworks and rolling mills. In previous censuses steel castings production was treated as part of steelworks and rolling mill industry. Special tabulation of 1937 figures has been made for comparisons.

Value of products in 1939 was $135,466,423, which is 26.5 per cent less than $184,227,710 reported for 1937. Wage earners employed in 1939 numbered 30,088 which was 27.3 per cent less than 41,380 in 1937. Wages, $41,941,774, were 32.7 per cent less than $62,351,378 paid in 1937. Number of establishments reporting in 1937 was 146; in 1939 it was 164.

McKee's 1940 Bookings Double Previous Record

■ Contracts awarded in 1940 to Arthur G. McKee & Co., Cleveland, engineering firm, doubled in aggregate dollar volume the company's best previous year, it was reported last week. Less than 20 per cent of business booked, the company pointed out, was completed in 1940; remainder is expected to be completed this year.

Company's net income in 1940, before federal and excess profits taxes, was $965,000; this was an all-time high. Net earnings after taxes were estimated to be $593,000 or $7 per share on common stock. This was exceeded only in 1938, when net income was $612,771 or $7.45 per share.

Extra dividend of 59 cents per share was declared, in addition to a dividend of 25 cents per share. Payments in 1940 totaled $3.75 per share, compared with $3.50 per share in 1939.

Forty per cent of the company's business last year was for foreign construction. Approximately 75 per cent of its contracts were for iron and steelworks construction; remainder was awarded by the petroleum industry.

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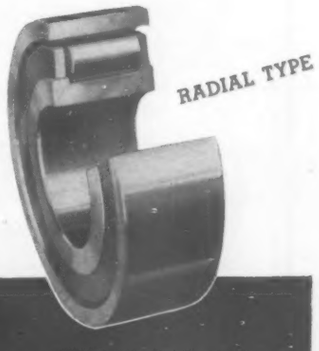

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Appointees Named for New Aluminum Plant

■ H. L. Charlton, vice president, Reynolds Metals Co., Richmond, Va., will be in charge of erection and purchases at the company's aluminum plant now under construction at Sheffield, Ala., according to R. S. Reynolds, president.

Basil Horsfield will be manager of the new $23,500,000 plant; R. S. Sherwin, consulting engineer responsible for all chemical processing; and B. L. Baxter, chief electrical engineer.

W. W. Binford is to be operating superintendent of the aluminum plant, and J. C. Black, operating superintendent of the aluminum reduction plant. L. W. Adkins will act as chief clerk; Paul E. Winnia, resident purchasing agent; and Gilmore S. Hamill, resident personnel manager.

W. C. Diggs has been appointed mechanical engineer in charge of maintenance; C. E. Baumgarten, chemical engineer; J. E. Nordquist, electrical engineer; R. S. Sherwin Jr., chemical engineer; W. C. Hawkins, assistant purchasing agent; I. J. Martin, mechanical engineer; J. D. Oliver, traffic manager; and E. J. Appel, aluminum production engineer.

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Aluminum Shortage Denied by Stettinius

■ Edward R. Stettinius Jr., national defense commissioner in charge of the raw materials, commenting on recent reports of alleged shortages in aluminum supplies, such as strong alloy sheet, extrusions, tubing, castings, and forgings for aircraft production in the defense program, said:

"Investigations just completed disclosed no serious shortages in aluminum supplies for aircraft and other military items now required for national defense. Certain temporary delays in delivery will doubtless occur under the rapid and unprecedented expansion demanded by the defense effort. New construction, however, is under way to increase fabricating facilities sufficiently in advance of plant increases in aircraft production to meet all military requirements. This expansion will increase capacity in the various branches of the aluminum industry from two to five times that of September, 1940.

"The Aluminum Co. of America, the Reynolds Metal Co. and other fabricators are increasing their facilities for making strong alloy sheet, extrusions, tubing, rolled products and basic metal in ingot form.

"In the last three months forge-hammer capacity has been increased 36 per cent. An additional 94 per cent increase is scheduled to come into operation during January and February. . . .

"Strong alloy sheet mill capacity, now roughly 8,000,000 pounds per month, is scheduled to increase to 12,500,000 pounds per month in March, 1941, 15,000,000 pounds per month in August, 1941 and 22,500,000 pounds per month in June, 1942.

"Since September, 1940 total shipments of aluminum materials have been made to aircraft manufacturing companies in amounts considerably in excess of those necessary to meet current total military aircraft delivery schedules.

"On the basis of our investigation, several reports of shortages appear to have arisen mainly from fear of failure of future deliveries. This fear may be attributable to lack of general understanding as to the scope of construction which the national defense advisory commission is now in a position to announce as under way."

■ Aluminum castings for use in Allison liquid-cooled airplane engines will be produced in a new foundry just completed by the Delco-Remy division of General Motors Corp., Anderson, Ind.

December Iron Production at New Peak; Operating Rate 97 Per Cent

■ VIRTUAL capacity operations in the second half of 1940 brought aggregate production of coke pig iron and ferroalloys in United States in the year to 46,923,527 net tons. This was exceeded only in 1929, when aggregate output was 47,342,605 tons. Total in 1939 was 35,310,042 tons; 41,156,422 tons in 1938 and 41,114,236 tons in 1937.

Aggregate production of all pig iron last year, including coke iron, charcoal iron and coke and electric furnace ferroalloys, was approximately 47,394,850 tons. This was second only to output of 47,727,661 tons in 1929, and compared with 35,677,097 tons produced in 1939. In 1937, total output of pig iron and ferroalloys was 41,582,550 tons.

Operating rate in January, 1940, was 85.4 per cent of capacity, with 177 stacks active, down 4 points and 14 stacks from the month preceding. Successive declines in the next three months brought the rate down to 68.9 per cent in April, with 155 furnaces in blast. Beginning in May, operating rate in the succeeding months showed a consecutive rise through to December, when it was 97.0 per cent with 202 stacks in blast Dec. 31.

Total production of coke pig iron and ferroalloys in December was 4,571,715 tons, according to reports from operators of the country's 231 potential coke blast furnaces and based on some estimates for output the last day or two of the month. This was 174,059 tons or 4 per cent greater than November's total, 4,397,656 tons, and exceeded output in December, 1939, by 351,997 tons or 8.3 per cent.

Stacks in blast Dec. 31 totaled 202, highest since October, 1929, when 203 were active and production for the month totaled 4,018,724 tons. Total of stacks active was unchanged from November.

Three furnaces were reported put in blast in December, and three were blown out or banked. One merchant stack was put in blast and two of the steelworks or nonmerchant classification. Stacks blown out were all nonmerchant. Stacks put in blast in December:

In Illinois, South Works Old No. 3 of Carnegie-Illinois Steel Corp. In Ohio: Campbell No. 3, Youngstown Sheet & Tube Co. In Pennsylania: one Palmerton, New Jersey Zinc Co.

Stacks blown out: In Alabama: Ensley No. 3, Tennessee Coal, Iron & Railroad Co. In Illinois: South Works Old No. 1, Carnegie-Illinois Steel Corp., and South Chicago No. 2, Wisconsin Steel Works.

Speedometer Co. Adopts Dry Lubricant Method

■ Probably no piece of automobile equipment receives so little attention from a lubrication standpoint as the car's speedometer.

To offset this condition and reduce failures, a prominent speedometer producer now combines running-in of speedometers with a method of impregnating the wear surfaces with a dry lubricant made by Acheson Colloids Corp., Port Huron, Mich.

Running in of the mechanism is carried out with 'dag' colloidal graphite as a lubricant. This creates a series of 'graphoid' dry-lubricating surfaces on the small parts most subject to wear—the fine colloidal graphite particles working into the minute spaces in the wear surface of the part, providing a relatively "permanent" dry-lubricating film.

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Canada Establishes Records in Industrial Production in 1940

TORONTO, ONT.

■ CANADA at war is a much more important factor in world economics, trade and industry than was Canada in peace. Thus comparisons with previous years, with the possible exception of the last World war period, would mean little.

When 1940 figures are fully tabulated they will reveal sensational progress in all lines of industrial endeavor. Expenditure on behalf of the Canadian and British governments through purchasing agencies in this country in the past 12 months exceeded $1,025,000,000, or approximately $25,000,000 more than was spent in the Dominion throughout the entire first World war. While ordinary peace-time business in the past year would compare favorably with the year immediately preceding, war effort and expenditure overshadowed by a very wide margin, anything previously accomplished in this country.

The year just ended was absorbed largely for the purpose of building a war machine that would be capable of supplying a very substantial part of the sinews of war for both Canada and Great Britain, and no line of industry was neglected. Canada is being set up as a principal arsenal of the British Empire and when her war machine is fully completed, within the next six or eight months, will have a production capacity exceeding $2,000,000,000 a year.

As a result of expenditures on plant and equipment during the past year, Canada opens 1941 with industry equipped for production of 40 to 50 per cent greater than in any previous year. To provide business for this greatly expanded industry the minister of finance has announced a financing program, in addition to ordinary revenue, which calls for federal government bond issues this year totaling $1,000,000,000. In addition large expenditure on behalf of the British government for war materials of every description, will continue to pour into this country.

From an industrial standpoint Canada made more direct progress in the past year than it did in any previous 10-year period. In this respect C. D. Howe, minister of munitions and supply, recently stated:

"Armament factories and plant extensions are being built all across the country, and contracts let recently assure continued activity in the heavy construction industry. Factories and plant extensions for which financial commitments have been made by the crown have a total value of some $250,000,000. Some of these plants already have been completed and are in operation. The program includes explosive, chemical, ammunition, steel, automotive, aircraft, base metals and other plants."

In addition to the above sum provided through government sources, approximately $150,000,000 has been or is being spent by various companies engaged in armament work.

Among the more important purchases by the government in the past year were those for ships, aircraft, motor vehicles, and preparations for production of armament, munitions and explosives. Canada's shipbuilding program calls for expenditure of approximately $80,000,000, with similar amounts for motor vehicles and explosives works. The aircraft industry has received orders totaling about $100,000,000. All plants receiving war orders are assured capacity production through the current year.

In their effort to provide raw ma-

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Low Phos — English — French

FERRO MANGANESE

Standard — Low Carbon

MANGANESE ORE

Open Hearth Use — Blast Furnace Use

IRON ORES

CHROME ORE

Lump — Ground

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terials for Canada's vast and growing war effort, the various primary producers were not found wanting. In the production of minerals as well as semifinished and finished steel, all past records were shattered during the past year, and, as the new year opens, everything points to further achievements in this direction.

T. A. Crerar, minister of mines for Canada, in a statement released at the year's end, announced mineral production will pass $500,000,000 for the first time in history. The year 1939 broke all previous records with output valued at $474,602,000.

Gold production valued at more than $200,000,000, compared with $184,000,000 in 1939, was outstanding. Value of base metals production was not disclosed for the year, but copper production passed the $60,000,000 reported for 1939 and nickel the $50,000,000 figure of last year.

Iron and steel production in 1940 soared to an all-time high and with additional blast-furnace and open-hearth capacity, now being provided, output for the coming year will show further sharp gains. In addition Canada's imports under the head of iron and steel exceeded all previous records. Imports from the United States alone, totaled approximately $750,000,000. The accompanying table shows comparative figures on iron and steel production for Canada covering the years 1925 to 1940.

Canadian Iron, Steel Production

(Gross Tons)

Year	Pig iron	Steel ingots	Steel castings	Ferroalloys
1929	1,090,244	1,309,543	70,445	80,010
1932	144,130	312,360	22,915	16,161
1935	605,627	907,870	31,360	55,520
1936	678,231	1,081,549	34,230	76,284
1937	898,855	1,334,164	66,847	75,888
1938	705,427	1,103,004	50,568	55,926
1939	756,182	1,330,407	54,420	75,234
*1940	1,170,000	1,940,000	70,500	131,000

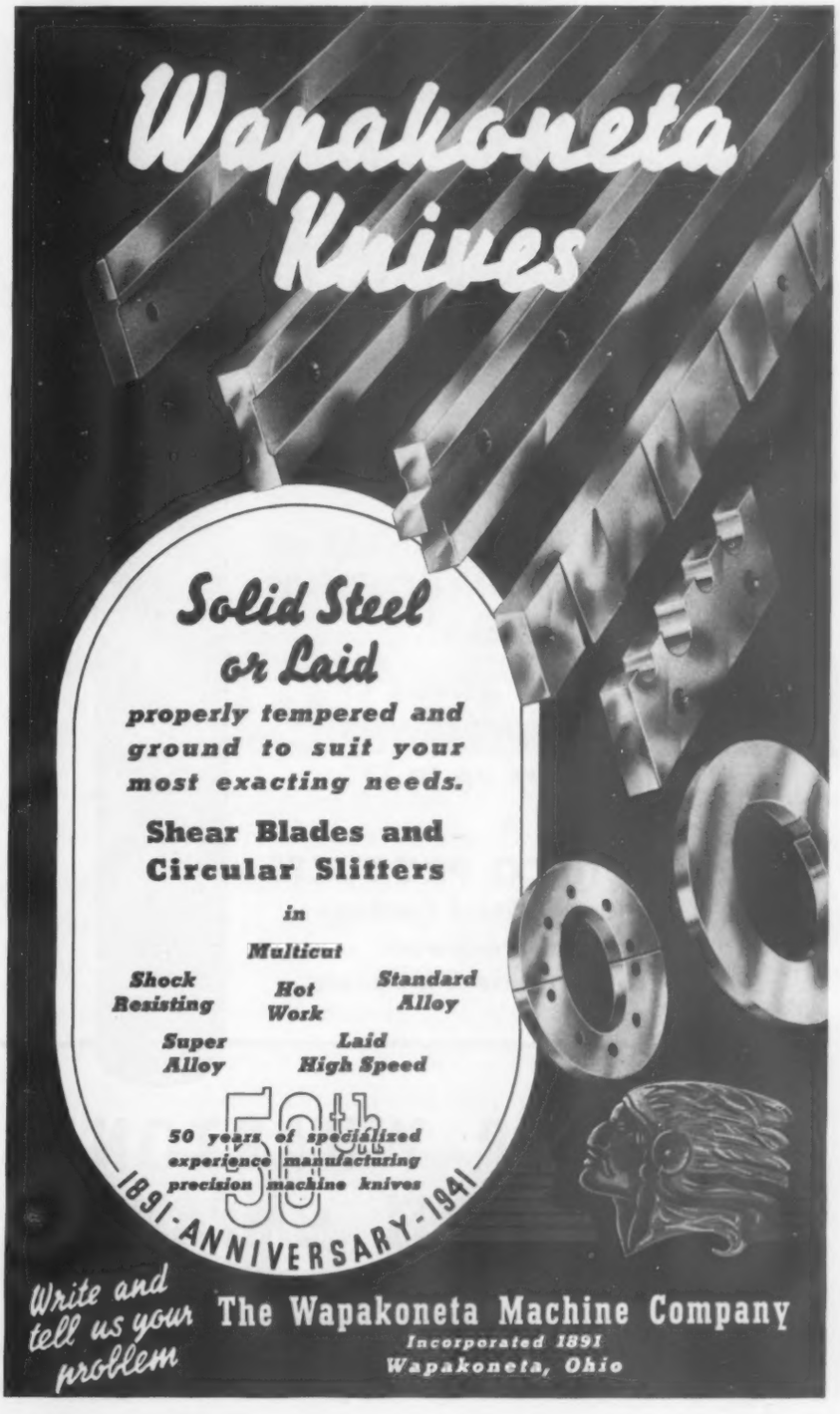
*December estimated.

Foote Bros. Expands To Make Aircraft Gears

■ Foote Bros. Gear & Machine Corp., Chicago, has scheduled a $1,020,000 expansion for production of gears for aircraft engines. Expansion includes purchase of the Central Steel & Wire Co. building in Chicago. Remainder will be invested in machinery.

Central Steel & Wire building will add 125,000 square feet to manufacturing plant. The Foote company will continue to manufacture in its present plant a general line of cut gears, speed reducers, transmission devices and special equipment for the aircraft and for other industries.

Cold Metal Process Votes $825 Dividend

■ Directors of Cold Metal Process Co., Lowellville, O., last week declared an $825 dividend, $100 in cash and $725 in notes maturing April 1. Two thousand shares are outstanding. A $500 dividend was voted several months ago, following a settlement with United States Steel Corp. covering royalties on the Steckel process, which is owned by Cold Metal Process Co.

Defense Awards Still Numerically Heavy but Smaller Individually

■ COMPLETION of the initial or large contract stage in the national defense program has been evident the past few weeks. Defense contracts awarded by the departments of war and the navy, while numerically heavy, have been smaller individually.

Range of items contracted for is still broadening. Quartermaster corps awards indicate the vast quantity of supplies required to accommodate trainees already in service and those yet to be drafted. Navy department's bureau of supplies and accounts continues heavy purchases in many fields.

Provision for expanded production of military supplies, aircraft, munitions and other requirements, is demonstrated in the expansion awards granted manufacturers. Plant construction and equipment, financed by the government for defense manufacture, is heavy.

War department last week authorized selection of sites for government-owned plants as follows: Milan, Tenn., a $14,000,000 ammunition-loading plant to be operated by Procter & Gamble Defense Corp., Cincinnati; Sandusky, O., an $11,000,000 explosives plant to be operated by Trojan Powder Co., Allentown, Pa.

Other construction authorized by the war department: Hickam and Wheeler fields, Hawaii, additional temporary buildings and facilities, to cost $1,687,100; air corps shop hangar at Bowman field, Kentucky, $120,000. Link Aviation Devices Inc., Binghamton, N. Y., was awarded a $323,432 contract for plant expansion construction to increase production of Link trainers.

War department last week reported the following:

Signal Corps Awards

Air Communications Inc., Kansas City, Mo., component equipment for radio, $101,827.50.

American Automatic Electric Sales Co., Chicago, switchboards and handsets, $33,935.15.

Bendix Radio Corp., Baltimore, components for frequency meters, $44,527.

Bunnell, J. H., & Co., New York, control boxes, receivers, transmitter for radio, control shafts, $21,849.70.

Cardwell, Allen B., Mfg. Corp., Brooklyn, N. Y., telegraph sets, $24,467.18.

Continental Electric Co. Inc., Newark, N. J,. power units and armature for generators, $25,165.

Cussack Machined Products Inc., Long Island City, N. Y., mast bases, $11,429.30.

Dayton Wheel Co., Dayton, O., reel cart, $31.093.

Dictaphone Corp., New York, transmitters, $17,250.

Kellogg Switchboard & Supply Co., Chicago, plugs and telephones, $199,880.

Leach Co., Oshkcsh, Wis., reel units, $192,560.

North Electric Mfg. Co., Galion, O., head and chest sets, $94,500.

Parish Pressed Steel Co., Reading, Pa., reels, $95,562.18.

Radio Recepter Co. Inc., New York, rectifier power equipment, $215,016.15.

RCA Mfg. Co. Inc., Camden, N. J., radio receivers, $180,350.

Teletype Corp., Chicago, teletype machines and transmitter distributor sets, $211,750.07.

Western Electrical Instrument Corp., Newark, N. J., test sets, $78,005.92.

Widin Metal Goods Co., Garwood, N. J., wire pikes, $40,312.61.

Quartermaster Corps Awards

Baruch Corp., Los Angeles, general hospital, Santa Barbara, Calif., $1,062,876.

Brown & Schrepferman Inc., Denver, semi-permanent theatre, Lowry field, Colorado, $58,847.

Colvin, Leslie, Indianapolis, general hospital, Ft. Benjamin Harrison, Indiana, $1,596,300.

Dattner, Henry, Detroit, addition to aero repair shop, Langley field, Virginia, $106,700.

Griffin Construction Co. Inc., and MacDougald Construction Co., Atlanta, Ga., general hospital, Atlanta, $2,463,712.

Heslep, John C., Columbia, S. C., and C. Y. Thomason Co., Greenwood, S. C., general hospital construction work, $1,344,316.

McDevitt, J. J., Co., Charlotte, N. C.; V. B. Higgins, Greensboro, N. C.; F. N. Thompson, Charlotte, N. C.; and E. W. Grannis, Fayetteville, N. C., anti-aircraft firing center, Wilmington, N. C., $8,612,495.

Moore & Roberts, and Bert O. Sommers, San Francisco, temporary housing, Letterman general hospital, California, $138,300 and $20,200, respectively.

Owens-Ames-Kimball, Grand Rapids, Mich., temporary housing, Ft. Custer, Michigan, $22,800.

Schader, A. D., San Francisco, extension of railroad spur, Presidio of San Francisco, $4797.

Sopp, Carl, Los Angeles, radio transmitter building, Muroc Lake, California, $3969.

Stang, August, Philadelphia, hangar, Frederick municipal airport, Maryland, $110,150.

Stilwell Construction Co., Macon, Ga., temporary housing, Ft. Oglethorpe, Georgia, $339,500.

Williams Co., Norfolk, Va., plumbing and heating systems, gas fitting and water heaters for temporary buildings, MacDill field, Florida, $156,155.

Ordnance Department Awards

American Locomotive Co., Railway Steel-Spring division, New York, springs, $25,782.24.

American Machine & Metals Inc., East Moline, Ill., washing machines, $2554.

Armstrong-Blum Mfg. Co., Chicago, cutting machines, $3504.36.

Baird Machine Co., Bridgeport, Conn., machinery, $1544.

Barber-Colman Co., Rockford, Ill., cutters, $1459.10.

Bay State Tool & Machine Co., Springfield, Mass., small arms materiel and machinery, $35,582.05.

Bendix Aviation Corp., Scintilla Magneto division, Sidney, N. Y., magneto switches, $1328.

Bohn Aluminum & Brass Corp., Detroit, aluminum alloy rod, $91,757.10.

Brown & Sharpe Mfg. Co., Providence, R. I., gages, $3461.86.

Brown Instrument Co., Philadelphia, valves and thermostats, $1822.52.

Bruning, Charles, Co. Inc., Chicago, photo print machines, $1253.53.

Bullard Co., Bridgeport, Conn., boring mills, $299,815.70.

Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, grinders, milling machines, $37,421.55.

Cleveland Cutter & Reamer Co., Cleveland, cutters, $1174.50.

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., small arms materiel, $4026.75.

Connecticut Tool & Engineering Co., Bridgeport, Conn., gages, $1710.

Derbyshire Machine & Tool Co., Philadelphia, tools, $13,350.60.

Ex-Cell-O Corp., Continental Tool Works division, Detroit, broach sections, $1274.05.

Fidelity Machine Co., Philadelphia, tools for small arms, $19,110.

Gallmeyer & Livingston Co., Grand Rapids, Mich., grinders, $5555.50.

Gardner-Denver Co., New York, air compressors, $7752.

Greenfield Tap & Die Corp., Greenfield, Mass., gages, $6490.

Hadley Special Tool Co. Inc., Boston, small arms materiel, $22,858.20.

Hamilton Metal Products Co., Hamilton, O., steel chests, $5027.58.

Hanson-Whitney Machine Co., Hartford, Conn., gages, $3744.64.

Haskins, R. G., Co., Chicago, machines, $1039.44.

Hershey Metal Products Inc., Derby, Conn., small arms ammunition, $106,675.

Hutchison Mfg. Co., Norristown, Pa., tools, $1404.

Illinois Tool Works, Chicago, machines, $15,000.

Ingersoll Milling Machine Co., Rockford, Ill., cutters, $2718.

Johnson Brass Foundry Co., Roxbury, Mass., bronze castings, $2911.87.

LeBlond, R. K., Machine Tool Co., Cincinnati, cutter grinders, $3980.

Leeds & Northrup Co., Philadelphia, recording instruments, $1841.20.

Machinery Builders Inc., Long Island City, N. Y., machines, $1472.

Magnus Tool & Die Co., Newark, N. J., gages, $1745.

Master Metal Products Inc., Buffalo, steel chests, $14,323.86.

McKenna Metals Co., Latrobe, Pa., lathes, $2173.50.

Moline Furniture Works, Moline, Ill., artillery materiel, $9476.

National Broach & Machine Co., Detroit, milling machines, $26,316.

National Tool Co., Cleveland, milling cutters, $1109.10.

Niles-Bement-Pond Co., Pratt & Whitney division, Hartford, Conn., gages, $2125.

Poor & Co., Canton, O., forgings, $1768.

Republic Steel Corp., Cleveland, small arms materiel, $95,513.

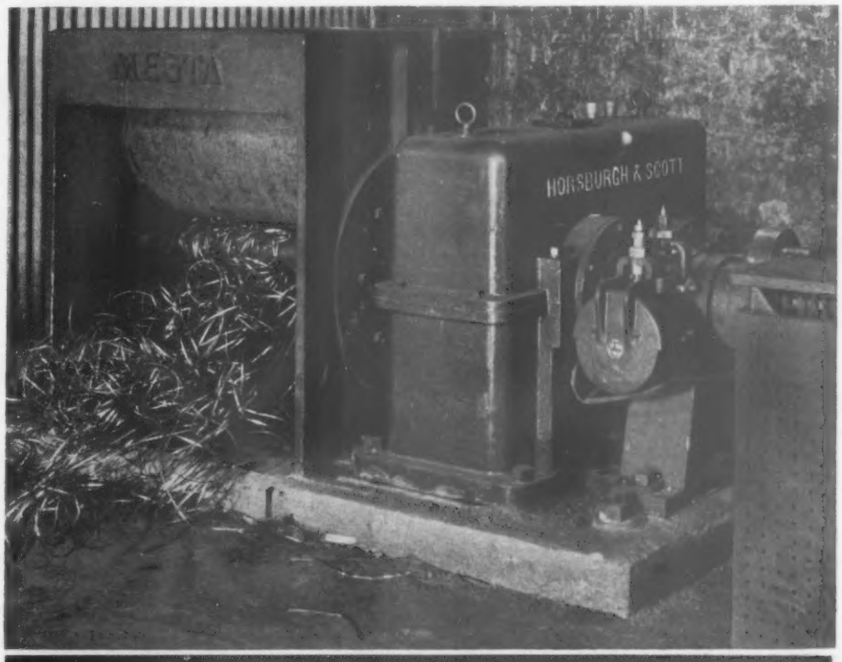
Reska Spline Products Co., Chicago, gages, $1493.

Revere Copper & Brass Inc., Baltimore, small arms ammunition, brass $141,526.60.

Roessler Machine Co., Elkins Park, Pa., tools for small arms, $34,611.

Sears Saddlery Co., Davenport, Iowa, ammunition components, $13,466.25.

Seymour Products Co., Seymour, Conn.,



IT'S BEING BALLED UP

» » » but this time it's for a good purpose. Here a Horsburgh & Scott Double Reduction Herringbone Speed Reducer is driving a metal scrap baller and doing a fine job. Smooth, powerful, quiet transmission of power with design for large starting and momentary overloads are all inherent qualities of Horsburgh & Scott Reducers. There's a Horsburgh & Scott Reducer for every purpose in industry . . . learn about the complete line of Herringbone, Helical and Worm Gear Speed Reducers.

Send note on Company Letterhead for Speed Reducer Catalog 39

THE HORSBURGH & SCOTT CO.

GEARS AND SPEED REDUCERS

5112 HAMILTON AVENUE • CLEVELAND, OHIO, U. S. A.

small arms materiel, $61,938.88.

Shuler Axle Co. Inc., Louisville, Ky., drop forgings, $9906.60.

Somerville Machine & Foundry Co., Somerville, Mass., bronze castings, $53,437.36.

Standard Dry Kiln Co., Indianapolis, equipment for drying kilns, $10,155.

Standard Tool & Die Corp., West Allis, Wis., gages, $3465.

Stevens-Walden Inc., Worcester, Mass., tools, $51,250.80.

Taft-Peirce Mfg. Co., Woonsocket, R. I., gages, $2544.64.

Uchtorff Co., Davenport, Iowa, ammunition chests, $18,588.

Union Twist Drill Co., Athol, Mass., cutters, $3220.

Vaird Machine Co., Stratford, Conn., machinery, $2890.

Veit & Young, Philadelphia, tools, $19,218.10.

Vinco Corp., Detroit, gages, $1529.70.

Watson-Stillman Co., Roselle, N. J., presses, $8000.

Weldon Tool Co., Cleveland, cutters, $2937.

Wiedemann Machine Co., Philadelphia, gages, $8013.50.

Worthington Pump & Machinery Corp., Harrison, N. J., pumps, $4661.

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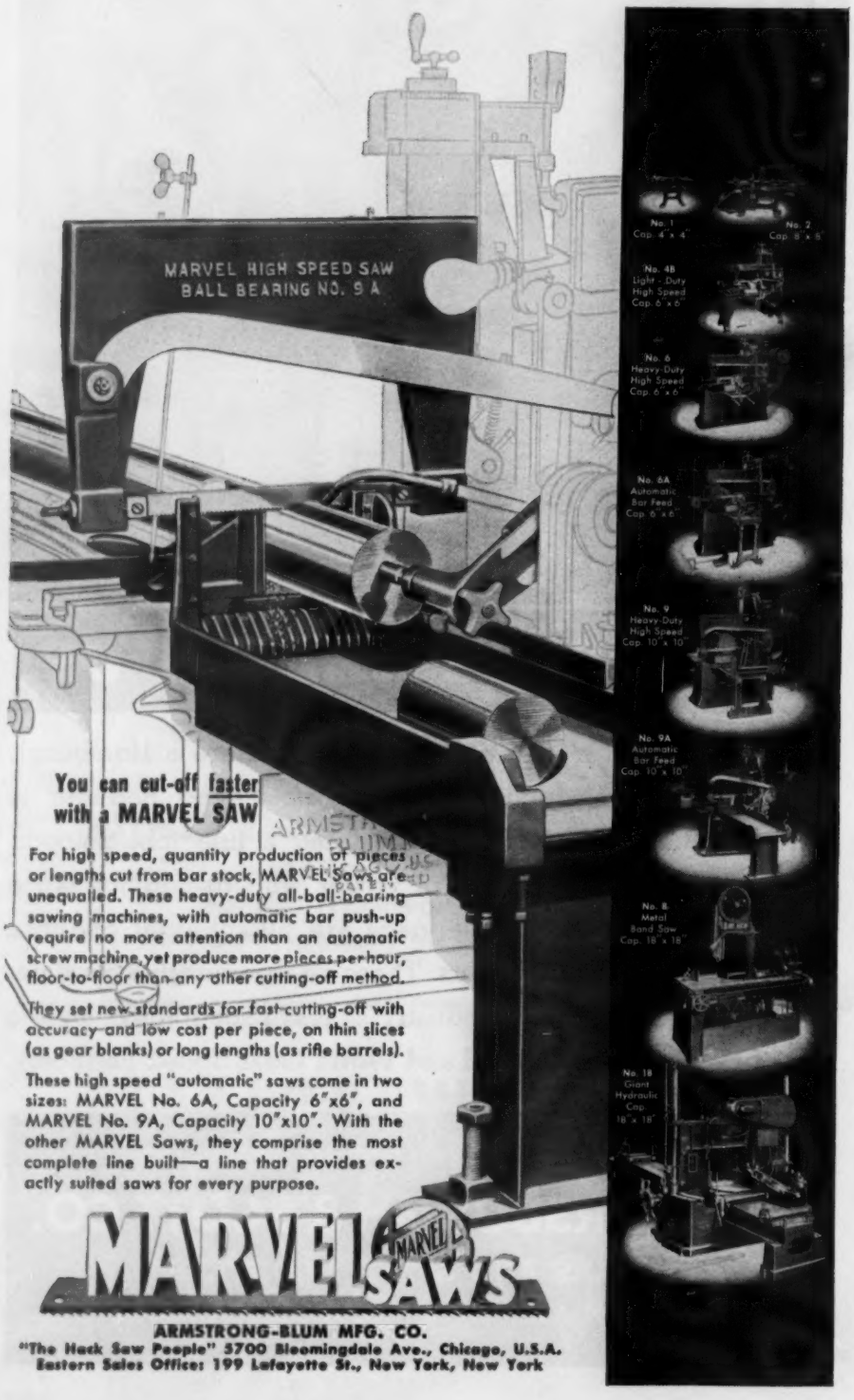
Navy department announced the following:

Bureau of Supplies and Accounts Awards

Aluminum Co. of America, Pittsburgh, magnesium powder, $44,460.

American Chain & Cable Co. Inc., American Chain division, York, Pa., rings and shackles, $10,923.15.


MARVEL HIGH SPEED SAW
BALL BEARING NO. 9 A
No. 1 Cap. 4" x 4"
No. 2 Cap. 5" x 5"
No. 4B Light - Duty High Speed Cap. 6" x 6"
No. 6 Heavy-Duty High Speed Cap. 6" x 6"
No. 6A Automatic Bar Feed Cap. 6" x 6"
No. 9 Heavy-Duty High Speed Cap. 10" x 10"
No. 9A Automatic Bar Feed Cap. 10" x 10"
No. 8 Metal Band Saw Cap. 18" x 18"
No. 18 Giant Hydraulic Cap. 18" x 18"

You can cut-off faster with a MARVEL SAW

For high speed, quantity production of pieces or lengths cut from bar stock, MARVEL Saws are unequalled. These heavy-duty all-ball-bearing sawing machines, with automatic bar push-up require no more attention than an automatic screw machine, yet produce more pieces per hour, floor-to-floor than any other cutting-off method.

They set new standards for fast cutting-off with accuracy and low cost per piece, on thin slices (as gear blanks) or long lengths (as rifle barrels).

These high speed "automatic" saws come in two sizes: MARVEL No. 6A, Capacity 6"x6", and MARVEL No. 9A, Capacity 10"x10". With the other MARVEL Saws, they comprise the most complete line built—a line that provides exactly suited saws for every purpose.

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People" 5700 Bloomingdale Ave., Chicago, U.S.A.
Eastern Sales Office: 199 Lafayette St., New York, New York

American Hardware & Equipment Co., Charlotte, N. C., woodworkers' chisels, $7153.74.

Badger Fire Extinguisher Co., Boston, fire extinguishers, $11,310.

Bardons & Oliver Inc., Cleveland, turret lathe, $5265.90.

Bertsch & Co. Inc., Cambridge City, Ind., plate straightening rolls, $14,535.

Billings & Spencer Co., Hartford, Conn., clamps, $11,363.71.

Borg Warner Corp., Marvel-Schebler Carburetor division, Flint, Mich., local track controls, $12,003.60.

Bullard Co., Bridgeport, Conn., turret lathes, $33,918.16.

Cincinnati Tool Co., Cincinnati, clamps, $10,269.05.

Copperweld Steel Co., Warren, O., nickel steel, $260,500.

Crucible Steel Co. of America, New York, slab steel, $16,412.17.

Enterprise Foundry Co., San Francisco, stretcher weights, $28,024.

General Machinery Corp., Niles Tool Works division, Hamilton, O., engine lathes, $130,260.47.

Graham, John H., & Co. Inc., New York, hacksaw blades, $32,536.08.

Harrold, H. J., Tool Co., Columbiana, O., screwdrivers, $16,465.92.

Hendey Machine Co., Torrington, Conn., precision lathes, $32,223.

International-Stacey Corp., Columbus, O., stretcher weights, $30,014.82.

Jaeger Machine Co., Columbus, O., self-priming, centrifugal pumps, $29,148.88.

Kidde, Walter, & Co. Inc., New York, fire extinguishers, $9394.

Kraeuter & Co. Inc., Newark, N. J., cutting punches, $7595.20.

Lake Washington Shipyards, Houghton, Wash., tank baulks, $1,879,542.

Landis Tool Co., Waynesboro, Pa., grinding machine, $5687.70.

Lidgerwood Mfg. Co., Elizabeth, N. J., anchor windlasses, $83,560.

Lionel Corp., Irvington, N. J., compensating binnacles, $137,080.

Master Rule Mfg. Co. Inc., Bronx, N. Y., steel tape rules, $10,756.85.

Millers Falls Co., Greenfield, Mass., steel rules, $5982.92.

Monarch Machine Tool Co., Sidney, O., engine lathes, $10,388.

Parker Wire Goods Co., Worcester, Mass., wood-boring bits, $18,134.94.

Pittsburgh Des Moines Steel Co., Pittsburgh, respiratory training equipment, $49,677.

Smyser-Royer Co., York, Pa., metallic-ladder treads, $6971.30.

Steuart Motor Co., Washington, motor trucks, $19,866.96.

Swind Machinery Co., Philadelphia, horizontal boring, milling and drilling machines, $52,641.

Taylor, James L., Mfg. Co., Poughkeepsie, N. Y., clamps, $6191.61.

United Aircraft Corp., Hamilton Standard Propeller division, East Hartford, Conn., propeller assembly, $237,351.24.

Universal Drafting Machine Co., Rochester, N. Y., parallel motion protractors, $31,085.20.

Warner & Swasey Co., Cleveland, turret lathes, $23,936.

Watson-Stillman Co., Roselle, N. J., hydraulic forcing press, $7295.

Weinstein, S., Supply Co., New York, screwdrivers, $8384.13.

Willard Storage Battery Co., Cleveland, storage batteries, $18,849.

Wollensak Optical Co., Rochester, N. Y., azimuth telescopes, $57,710.

■ Seventy-three selected industries, closely related to the national defense program, employed 2,970,419 wage earners in 1939, which was 11.8 per cent less than the same industries employed in 1937, according to the census of manufactures.

Wages paid to these employes totaled $3,842,745,210 for 1939, or 13.5 per cent less than was paid in 1937.

Stilwell Calls for Greater Productivity

■ Productivity of machines can be increased only by men, Clifford S. Stilwell, vice president, the Warner & Swasey Co., Cleveland, declared in a radio address last week.

Mr. Stilwell emphasized the machine tool industry was "all out for defense" and pointed to the tremendous expansion achieved by that industry since the war's outbreak.

Referring to President Roosevelt's recent radio appeal for more production, the speaker commented the administration's stand "still calls for specific detail."

"We need to know how many machine tools are required and when. When the machine tool industry is presented by the government with a specific problem of accomplishment, that assignment will be achieved . . . .

"It has been estimated that if there could be a 5 per cent increase in the efficiency of machine tools now in use, we should have immediately an additional productive capacity equal to all the machine tools built in America in 1939.

"Here is no question of labor shortage, nor of lengthened hours, nor of overtime wages. But nobody can increase the productivity of machines but men. Here is a potential source of increased production which would tremendously reduce any gap of labor shortage or choke-point in machine tools."

40% of Westinghouse Production for Defense

■ The electrical industry undertook its largest national defense production program in 1940, according to a summary of the year's engineering developments by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. At the same time, the summary reports, the industry put electricity to work on more peacetime jobs than ever before.

More than 40 per cent of $390,000,000 in new business received by Westinghouse last year was connected, directly or indirectly, with national defense. Company's backlog is estimated to exceed $215,000,000, with more than $140,000,000 for defense work.

To speed production of both regular and defense equipment, Westinghouse authorized about $23,000,000 for plant expansions and new manufacturing equipment in 1940; additional $9,000,000 has been authorized for 1941. Employment last year increased from 49,519 to more than 56,000.

Fifteen Westinghouse plants are currently engaged in defense production, with orders including manufacture of gun equipment for the navy; turbine-generator sets; ignitron rectifiers for processing metals for aircraft manufacture; transformers, switchgear and generators; X-ray equipment; aviation, commercial, industrial and floodlighting equipment. Unusual defense project under way at the East Pittsburgh works is construction of a 125-ton 40,000-horsepower motor for a new model airplane testing wind tunnel, for the army's Wright field at Dayton, O. This power machine is said to be the largest motor of its type.

Despite increase in national defense production, however, Westinghouse reports it is also continuing to increase its normal lines of production. Refrigerator sales, it is reported, were greatest last year.

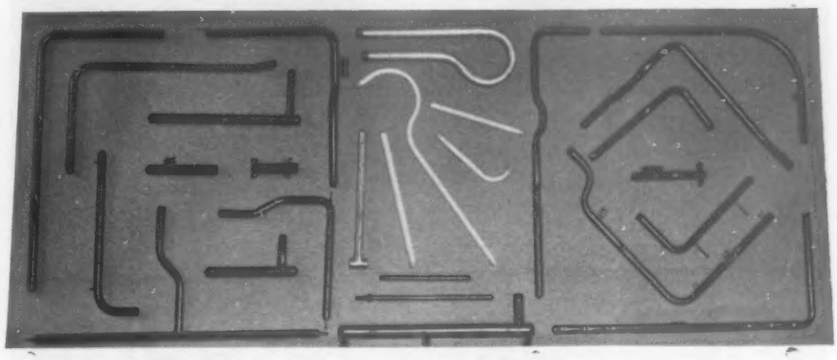
Among major research achievements last year were a new X-ray tube that can take pictures through opaque solids in one millionth of a second; infra-red lamps capable of drying 24-hour paint in one hour; a new way of releasing energy of the uranium atom by exploding it with a form of light ray; and high speed tests to determine how metals will stretch and relax.

PIPE FABRICATION

GAS RANGE MANIFOLDS

GAS FURNACE MANIFOLDS • FURNACE COILS

DIE HANDLES • GOOSENECKS



WE are now in a position to furnish gas furnace manifolds made under the same patented process as the gas range manifolds in any size to fit your requirements.

Both gas range and gas furnace manifolds are assembled to include BRACKETS, BOLTS, or both BRACKETS and BOLTS in combination.

Our *central location* in Lebanon, Ohio is ideal for nationwide service on Furnace Coils, Die Handles, and Goosenecks. The nature of our organization is such that special and *highly personalized service* is available to all our customers.

Let us assist you in your engineering problems. We offer a complete personal service without obligation to you.

PRODUCTION

PLATING WORKS, INC.

LEBANON, OHIO

Industrial Machinery Foreign Shipments Set New Record

■ UNITED STATES exports of industrial machinery in November established a new record for the second successive month, with total shipments amounting to $45,251,696, compared with $43,567,434 in October, the department of commerce reports. All the large machinery export classes showed moderate gains except textile, sewing and shoe machinery, which declined rather sharply.

Machine tool exports to England amounted to $19,218,029, or slightly below the October value of $19,902,633. November shipments to that country made up 77 per cent of total machine tool exports to all countries. Exports to other large purchasers of American machine tools were as follows: Consignments to Japan dropped to $478,008 from $1,393,434 in October; shipments to Russia jumped to $1,025,208 after having declined to $130,599 in the previous month; exports to Canada amounting to $2,614,978 were maintained on about the same level as in October when they totaled $2,678,330. All of Latin America took shipments valued at $199,041, compared with $147,161 in the preceding month.

Valued at $27,413,932, November exports of power-driven metalworking machinery reached a new high, 2 per cent above shipments in October. Shipments of milling machines rose to $6,053,585 from $4,917,159 in the previous month and exports of drilling machines were up to $1,656,819 from $1,329,796, but declines were recorded for lathes, down to $5,891,102 from $6,947,124, and for grinders, which dropped to $3,943,114 from $4,639,305.

In fact, total exports of machine tools were slightly below the previous month, but increases in other items combined to maintain the total for all power-driven metalworking machinery. Thus rolling mill equipment rose to $1,653,819 from $368,777 and forging machinery was up to $757,854 from $422,102.

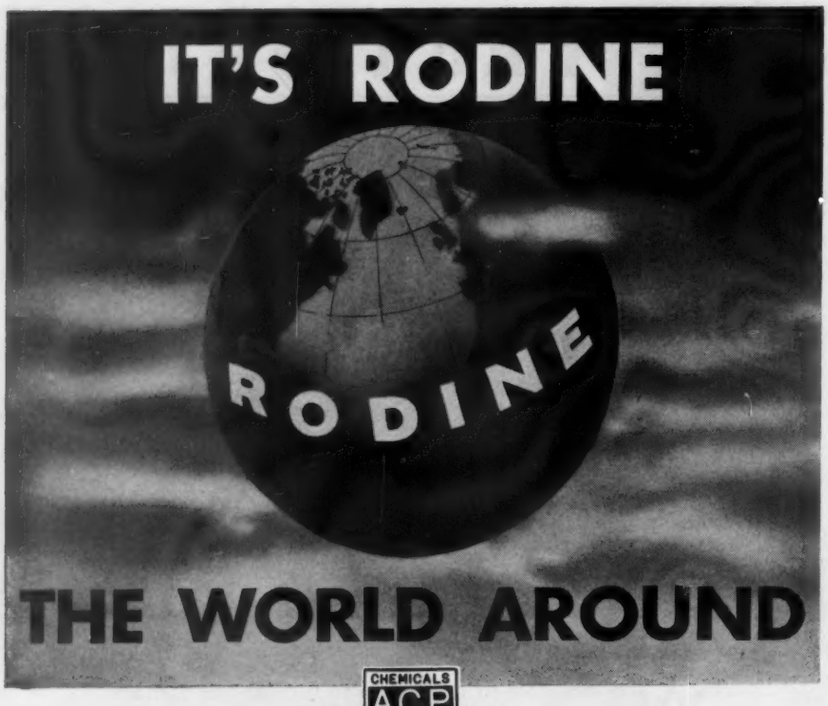
Gain in Other Items

Shipments of metalworking machinery other than power-driven amounted to $911,038 as against $811,255 in October.

Mining, well and pumping equipment valued at $3,758,680 was exported in November, a gain of 8 per cent over the preceding month. All three groups contributed to the increase: Mining and quarrying machinery rose to $1,137,721 from $1,033,663; oil well and refining equipment came to $1,758,086 as against $1,627,302; and pumping equipment totaled $862,873, compared with $830,043 in the preceding month.

Shipments of construction and conveying equipment amounted to $2,974,860 in November, an 8 per cent increase over October. Excavators and parts were up to $735,463 from $400,553, and exports of conveying equipment and parts rose to $392,597 from $325,413. Cranes, hoists and derricks, which proved to be a "bottleneck" during the World war, have shown increasing shipments in recent months; valued at $252,451 in September, exports rose to $433,486 in October, and again to $522,972 in November. A decline was recorded for graders and scrapers, with November shipments down to $443,280 from $541,245 in the previous month.

Total November exports of power generating machinery amounted to



CHEMICALS ACP PROCESSES

RODINE

Makes Pickling Efficient in Iron and Steel Mills in All Parts of the World

- Cuts Pickling Costs
- Gives a Brighter, More Uniform Surface
- Increases Tonnage
- Prevents Over-Pickling
- Eliminates Acid Fumes

CUPRODINE—Another World Famous Steel Mill Chemical. Forms a dense, bright, tight copper coating quickly . . . without the use of current.

AMERICAN CHEMICAL PAINT CO.
Main Office & Works AMBLER, PENNA.

$2,654,421, showing a gain of 8 per cent over the October figure. Shipments of diesel and semidiesel engines came to $319,344, compared with $221,857 in the preceding month; other internal combustion engines rose to $598,982 from $380,680; and engine parts and accessories were up to $519,046 from $318,603. November shipments of steam engines, boilers and accessories dropped to $484,793 from $844,155.

Textile Machinery Declines

A decline of 27 per cent was recorded for exports of textile, sewing and shoe machinery, with shipments in November valued at $1,505,271. Most of the decrease was due to the drop in textile machinery exports from $1,219,550 to $690,189. Shipments of sewing machines and parts came to $728,156 as against $781,421 in October and shoe machinery rose to $86,926 from $56,408.

November exports of "other industrial machinery" totaled $6,633,494, showing a gain of 15 per cent over the previous month. Shipments of ball and roller bearings continued to rise, reaching $1,179,225, compared with $1,039,812 in October; exports of air compressors amounted to $441,263, as against $330,911; valve shipments rose to $441,075 from $438,842; woodworking machinery came to $225,693, a decline from the previous month's $232,749; and sugar mill machinery was valued at $213,633, as against $223,734 in October.

Foreign shipments of printing and bookbinding equipment totaled $552,730, showing an increase of 42 per cent over the preceding month.

Farm Equipment Exports Advance 17 Per Cent

■ November exports of agricultural implements and machinery totaled $4,763,319 and represented a gain of 17 per cent over the corresponding 1939 shipments valued at $4,070,133, according to the commerce department.

Harvesting machinery exports during the month amounted to $242,938, 69 per cent above the November 1939 shipments which amounted to $143,319. All classes of harvesting machinery shared in the advance, the trade increasing in mowers to $39,314 compared with $9673 a year ago; in hayrakes and tedders to $13,043 from $1633; in harvesters and binders to $13,089 from $4514; in combines to $87,417 from $43,872, and in all other types to $90,075 from $83,627.

Foreign sales of tractors, parts and accessories totaled $3,664,542, a 20 per cent increase over the Nobember 1939 trade valued at $3,049,230. Wheel tractor shipments were off 30 per cent, to $1,071,825 compared with $1,538,896, but this loss was more than compensated by the 103 per cent gain in the tracklaying tractor exports, to $1,765,377 against $870,944.

Exports of engines for tractors advanced to $27,278 from $7402 a year ago, and of parts and accessories for tractors to $800,062 from $631,988.

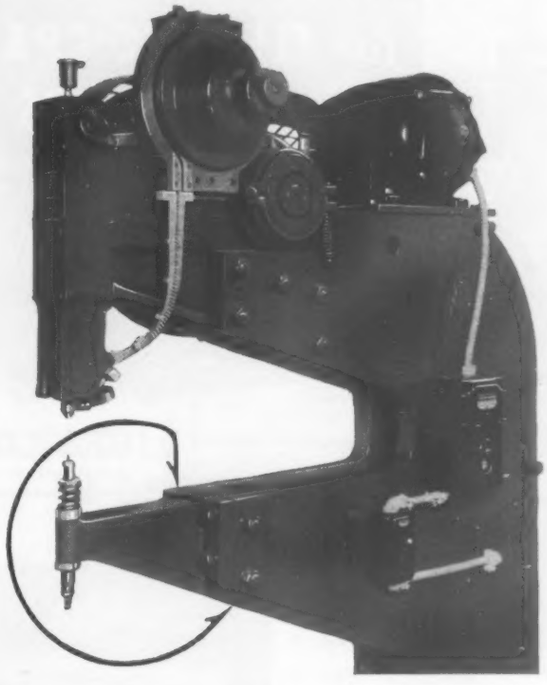
A slight gain was also recorded in tillage implements, November 1940 foreign sales of this type amounting to $450,264 compared with $432,026 for November 1939. Plow shipments totaled $156,761 against $136,522, but exports of harrows declined somewhat, to $61,736 compared with $86,685.

Seed separator exports showed a decline to $63,459 from $84,207, with threshers valued at $47,983 and $52,092, respectively, making up most of the trade in this type of equipment.

Of the miscellaneous types of equipment, increased shipments were made of cream separators and other dairy equipment which were valued at $40,479 compared with $34,552 a year ago, and feed cutters, crushers, and grinders in which the trade amounted to $30,332 compared with $14,921.

for more solid rivet joints per **RIVITOR**

(minimized change-over time)



● Sustained production with but small loss of time for "change-overs", is possible with this "Interchangeable Horn Type" RIVITOR.

● Complete horn sections, carrying the anvil mechanism, may be transferred to another Rivitor (this type) which has the required throat depth to get the next rivet locations.

This not only permits maximum machine utilization but also accommodates more automatic feed riveting without having to have additional complete machines. At the same time, the deep throat machines can be kept busy with work requiring that accommodation. Information on these and the other type Rivitors will be sent promptly, address The Tomkins-Johnson Co., 611 N. Mechanic Street, Jackson, Michigan.

this is a **TOMKINS-JOHNSON** *product*

Republic Steel Buys Troy, N. Y., Stack

■ Republic Steel Corp., Cleveland, has acquired ownership of the blast furnace owned by the Hudson Valley Fuel Corp. at Troy, N. Y.

Property, which includes 50 acres of land and necessary equipment, was first leased by Republic July 9, 1940, after having been idle since December, 1938. The blast furnace has a 17-foot 6-inch hearth diameter and produces merchant grades of iron.

Furnace requires an operating force of 225 men, who were employed by the former management and are residents of Troy. The blast furnace, which will use New York state materials entirely, was constructed in 1924 by the Troy Coke & Iron Co.

Harry Taylor, formerly of Buffalo, is superintendent.

Continental Can in $25,000,000 Expansion

■ "The $25,000,000 program of capital expenditure for the expansion and improvement of manufacturing facilities over the next three years, upon which our company recently embarked, may be expected to be one of the principal factors in our situation in 1941," said J. F. Hartlieb, president, Continental Can Co. Inc., last week.

"This program has been undertaken to provide us with larger and more efficient manufacturing facilities for new and existing products.

"Another factor to which we look for increased business in 1941 and future years is the program for expanding and integrating our research division. This work which we like others in this industry have carried on for many years has been responsible for the development of such products as cans for motor oil and for beer, both of which are now an important part of our production. We expect that this department will continue to develop other new products for our lines."

Push button control

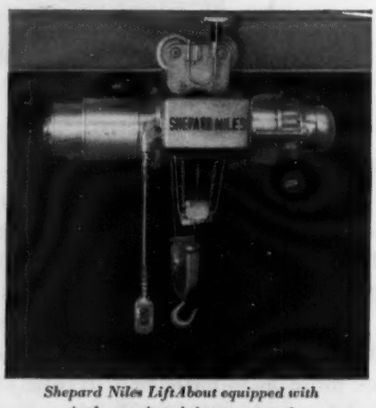
MULTIPLE OR SINGLE SPEED *for* ELECTRIC CRANES AND HOISTS

Shepard Niles multiple speed push button control for all 6 travel motions applied to 3-motor electric traveling crane.

SHEPARD NILES multiple speed push button control provides 5 selective speeds by one push button for each travel motion. Each button as it is pressed inward makes five electrical contacts, corresponding to five independent speeds in each direction of travel.

Push button master switch cases are of aluminum alloy and made slender enough to be grasped easily with the hand. An assembly of two or three master switches in tandem can be furnished for the control of 2-motor and 3-motor cranes and hoists. An emergency stop switch is provided at the lower end of the assembly.

WRITE FOR BULLETIN No. 129



Shepard Niles LiftAbout equipped with single speed push button control.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

358 SCHUYLER AVENUE . . . MONTOUR FALLS, N. Y.

Report Cost Control Increased Earnings

■ York Ice Machinery Corp., York, Pa., credits higher volume of sales and better control over costs for the improvement in profits last year over the period preceding. Sales in the fiscal year ended Sept. 30, 1940, aggregated $16,163,895 or 7.5 per cent greater than the year before. Net income in fiscal year 1940 was $483,122 after taxes, against a net loss of $185,077 in 1939.

Research and development program carried on by the company has broadened its sales outlets and transformed the nature of its business, it is reported. Reduction in seasonal peaks and valleys, important in manufacturing efficiency, was accomplished through sales planning and development of new products to bring about a steadier flow of orders.

Company's management is considering plans to change the corporate name and a proposal relating to its capital structure.

Malleable Metals in Art To Be Exhibited

■ Spanish treasure chests, Japanese armor, early American Indian relics, and other examples of the adaptability of malleable metals to decorative design will be shown in a public exhibition, entitled "With Hammer and Tongs; Malleable Metals in Diverse Design," to be opened in Cooper Union Museum for the Arts of Decoration, Cooper Square, New York, Feb. 3.

The art of American, European and Oriental metalworkers will be represented by a wide variety of objects from the museum's extensive collection, some of which date back to man's first discovery of the materials.

Forecasts 35% Gain in Industrial Building

■ A minimum increase of 35 per cent in industrial construction in 1941 is forecast by George A. Bryant, president and general manager, The Austin Co., Cleveland, who describes present facilities as "wholly inadequate" to meet defense needs.

Many firms now in rented quarters or in obsolete plants of their own are taking advantage of the current situation to build new modern plants, which, with better light, higher clearances, improved ventilation and basic flexibility, will become permanent homes when the present emergency is over, he states.

Fabricating shops equipped to turn out welded members are setting new records of construction speed. Fluorescent lighting equipment has raised standards of illumination by at least 100 per cent, he says.

Speed Construction at Two New Todd Shipyards

■ Work on construction of shipyards for the Todd-Bath Iron Shipbuilding Corp., Portland, Me., and the Todd-California Shipbuilding Corp., San Francisco, is proceeding at top speed. The two new companies, subsidiaries of the Todd Shipyards Corp., New York, have contracted to build 60 merchant ships for Great Britain, as noted in STEEL, Dec. 23, page 19.

William S. Newell, president, Bath Iron Works, Bath, Me., is president of the Todd-Bath Iron Shipbuilding Corp. Henry J. Kaiser, Oakland, Calif., a director of the Seattle-Tacoma Shipbuilding Corp., another Todd affiliate, is president of the Todd-California Shipbuilding Corp. Joseph H. Haag Jr., president, Todd Combustion Equipment Corp., is vice president of both the Maine and California companies.

Hunter Steel Liquidation Voted by Stockholders

■ Stockholders of Hunter Steel Co., Pittsburgh, steel fabricator, adopted at a special meeting, Dec. 27, 1940, a plan of liquidation submitted Dec. 17. Pursuant to the plan, Hunter Steel Co., controlled by Pittsburgh Coke & Iron Co., Pittsburgh, is being dissolved and has irrevocably transferred and paid over to the Peoples-Pittsburgh Trust Co. the respective accounts of the holders, other than Pittsburgh Coke & Iron.

The accounts, Hunter preferred and common stocks, will be paid at $25.29 per share on preferred and $2.42 per share on common. Preferred payments represent $22 per share plus accrued and unpaid dividends to date. Distributions to stockholders, other than Pittsburgh Coke & Iron, will be made in cash. To Pittsburgh Coke & Iron, distribution will be effected by transferring to it the remaining assets of Hunter Steel Co., subject, however, to the latter's liabilities.

Otis Steel To Spend $750,000 at Riverside

■ Otis Steel Co., Cleveland, will spend $750,000 for improvements at its Riverside plant, E. J. Kulas, president, announced last week.

Part of the program already is under way and the remainder will go forward as promptly as materials can be obtained. The program, in part, provides for increased annealing facilities for the sheet and cold-rolled strip mills and additional soaking pit capacity at the blooming mill. Program also contemplates improvements in the company's coke works and the installation of new turbo blowers and high-pressure boilers at the blast furnaces.

DoAll STEPS UP PRODUCTION

At the Ingersoll Milling Machine Company, Rockford, Ill., discs for bearing retainers are made from 3140 flat steel on a DoAll in 30 minutes each. Outside diameter is 12″, inside 9″. A DoAll automatic circle cutting attachment is used.

Other special parts made on the DoAll by Ingersoll include a target gauge in 15 minutes, 2 rocker arms in 12 minutes, head stops in 1 hour each.

INDISPENSABLE IN DEFENSE WORK

The DoAll is the rugged machine tool that effect such sensational savings in time, labor and material. Takes the place of lathe work, milling and shaping in thousands of plants. Now used in 30 countries for cutting every kind of metal in automobile factories, arsenals, ship yards, aeroplane plants, machine shops, etc.

CONTINENTAL BAND FILER

Does continuous filing, which means faster, better, smoother filing on all materials from toughest high-carbon steel to soft brass, wood, etc. Available are 12 styles of file bands, ⅜" and ¼" wide—flat, oval or half round. Ask for circular.

SPEEDMASTER

An important part of every DoAll Machine. Gives instant variable speed.

A compact unit, also sold separately for use on any other machines requiring variable speed. Produces any speed, 6 to 1 ratio, by mere touch of handle.

Let us send a factory trained man to your plant to show you what a DoAll can do and save for you.

FREE—Handbook on Contour Machining, 158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.

1324 S. Washington Ave.
Minneapolis, Minn.

Mirrors of Motordom

(*Concluded from Page* 216)

because we are geared to meet the heaviest buying demand in our experience. Our bank of unfilled orders at the turn of the year substantiates our opinion that the new year will contribute an all-time high for Cadillac business."—Nicholas Dreystadt, general manager, Cadillac Motor Car division, Detroit.

•

Record-Breaking Year

". . . . Several factors, in my opinion, justify a prediction for good business in 1941. In the first place, as far as Oldsmobile is concerned, the public has given our 1941 lines of cars a wonderful reception. I am firmly convinced that the coming year will see our record-breaking figures of 1940 surpassed. Secondly, the national defense program is raising payrolls and increasing employment in practically every section of the country. Also, with increased employment comes increased purchasing power and consequently a growing demand for all commodities. Oldsmobile is anticipating a continuance of present buying trends."—S. E. Skinner, general manager, Oldsmobile, Lansing, Mich.

•

To Do Its Part

". . . . Recognizing the need for mobilizing the facilities of the country in an effort to meet demands of a large-scale national defense program, Ford has taken active steps to play its part. Major activities which we now have under way include: Construction of a $21,000,000 airplane engine plant, including facilities, under way on a 24-hour day basis; establishment of a school for training navy men in the Ford plant in the use of a wide variety of machine tools and other industrial equipment essential to defense work, barracks for 950 men now nearing completion; construction of light, four-wheel drive 'reconnaissance and command' cars of new design for the army, initial order involving 1500 of these with deliveries to start in February; and construction of bomber service trucks and officers' staff cars. We are endeavoring to carry on our part in defense activities without disrupting normal production of cars and trucks, in anticipation of the substantial volume of domestic business we believe will continue for many months."—Edsel Ford, president, Ford Motor Co., Dearborn, Mich.

•

Defense First

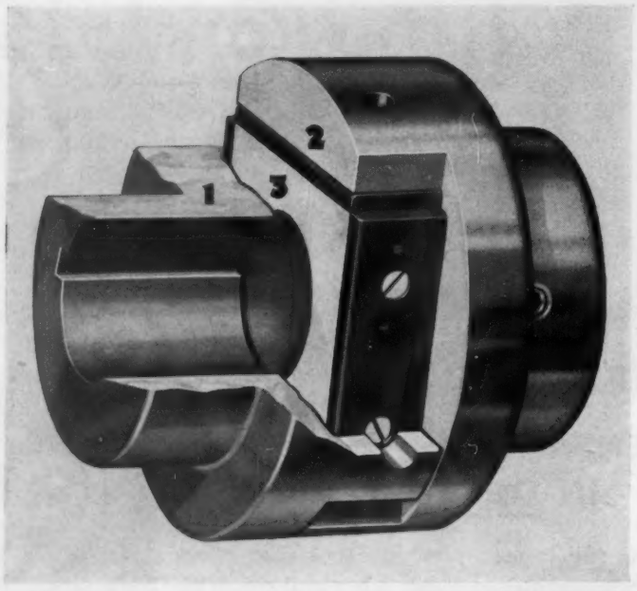
". . . . Co-operation in the defense program is the first order of business for the automobile industry. Today, Chrysler Corp. is building, equipping and manning for the army a new $20,000,000 tank plant which is expected to be completed for production in October. The army has placed a $33,500,000 order for one thousand 25-ton tanks. These will be produced at the rate of five per day on a one-shift basis. Chrysler Carp. also is building for the army more than 50,000 specially designed Dodge trucks and 4071 passenger cars, of which about 35,000 trucks and 1250 cars were shipped in 1940. In addition, the corporation already has turned out educational orders of munitions, including 75-millimeter shells, cartridge cases and bomb fuse noses. From its Airtemp plant in Dayton, O., it is shipping at the rate of four carloads a day, specially designed field stoves for the army."—K. T. Keller, president, Chrysler Corp., Detroit.

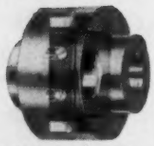
•

Greater Sales Volume

". . . . I am optimistic concerning the course of Buick business and am confident that the 1941 model season will see another new all-time high in production and sales. Every effort is being made to minimize seasonal fluctuations with the result

complete flexibility
IN A COUPLING
WITHOUT FLEXIBLE MATERIALS •





- Has only 3 simple, rugged parts—2 identical jaw flanges—1 floating *metallic* center block.
- The floating metallic center block which transmits load is free to float in any direction without cramping—binding—or usual friction and wear.
- Wear is absorbed by inexpensive non-metallic bearing strips on load bearing surfaces of the floating metallic center block. These are easily replaced without disturbing coupling alignment.
- No flexible materials which absorb energy and cause side thrust are used.
- Write for Catalog No. 361 which contains complete information.

AMERICAN FLEXIBLE COUPLING COMPANY • ERIE, PA.

(*Trade Name Reg. U. S. Pat. Off.*)

that heavy production has been scheduled during January and February consistent with market demands at that time of the year. . . . Buick plans are based on conservative estimates of the prospective market as a result of studies that have been made of the future course of consumer income and purchasing power. These show the definite effects of the national defense program which are being felt in major centers where defense production is under way. Estimates of Buick's 1941 model year have been revised upward. Approximately 25,000 units have been added to the sales objective, with plants now producing at the rate of about 350,000 units for the model year."—H. H. Curtice, general manager, Buick Motor division, Flint, Mich.

Steelworks Expansion

(*Continued from Page 292*)

mechanical coal mining equipment, erected new coal washing equipment.

Gulfsteel District: Enlargement of open-hearth furnaces and soaking pit capacity, strengthened open-hearth building and cranes to handle larger heats, wire fence processing machines, hot and cold bolt processing equipment, road mesh equipment for Truscon Steel.

Port Henry District: Mining equipment for increasing ore storage from mines, improved equipment at sintering plant, improved and additional equipment at the ore concentration plant.

Chateaugay Mining District: Equipment to increase ore tonnage from mines, ore concentration equipment.

Northern Coal Mines: Mechanicalization of mining properties, acquisition and equipping Clyde coal mine.

Steel & Tubes Division: Installation of additional tube welding equipment, improvements to Elyria plant.

Union Drawn Steel Division: New bar turning machines; annealing capacity and coil pickling equipment; building and heat treating equipment at Gary, Beaver Falls and Massillon plants; stainless finishing equipment at Massillon.

Bolt & Nut Division: Building for storage and shipping facilities, new hot and cold bolt makers, new straightening equipment.

Berger Mfg. Division: New office building and plant buildings, new paint mixing building and equipment.

Niles Steel Products Division: Additional manufacturing equipment, modernization of small container line.

Truscon Steel Co.: Additional manufacturing equipment for processing lines, automatic welding presses.

U. S. STEEL CORP. SUBSIDIARIES

Completed

Chicago Area: Remodeled blast furnaces, new temper mill, concentration of wire facilities, additional heat treating equipment for rods and wire.

Pittsburgh Area: Enlargement of blast furnaces.

Birmingham Area: Central ore conditioning and sintering plants.

Other Areas: Sintering plant, Cleveland. High-speed automatic sheet mill, San Francisco. Warehouse, Seattle.

Underway

Chicago Area: Improving blast furnaces, new electric furnace plant, new cold reducing tin plate equipment, modernizing electric distribution system, additional facilities for rolling small billets, rebuilding 142 coke ovens, new soaking pits and cranes, sundry replacement of open-hearth and auxiliary equipment.

Pittsburgh Area: Improving blast furnaces, enlarging open hearths, new cold reduction mill, power generation and distribution facilities, replacement of wire drawing equipment, facilities for producing welded steel barges, new armor plate making equipment including heat treating furnaces, facilities for fabricating light armor plate and for producing bombs, shells and shell forgings.

Birmingham Area: Additional battery of by-product coke ovens, new blast furnace, power plant, plate mill, sheet mill equipment and cold reduced tin plate facilities, equipment for ore and coal mines, facilities for making shell forgings.

Other Areas: Rebuilding blast furnace, facilities for producing stainless steel strip, annealing furnaces, Cleveland. Warehouse, San Francisco. Reconstruction of wire and wire product making facilities, Worcester, Mass. Additional facilities for construction of vessels for navy and maritime commission, New York area.

YOUNGSTOWN SHEET & TUBE CO.

Completed

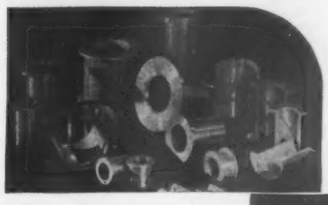
Brier Hill Works: Wire fence around steel plant and plate mill properties. One circular soaking pit. Ingot turnaround at blooming mill and ingot scale. Relocation of 72-inch hot saw at No. 2 billet yard. Rebuilt two soaking pits. Dolomite machine, hot top equipment, 30 ingot mold cars.

Campbell Works: 50 ingot cars and equipment for handling bessemer steel. Gasoline-electric locomotive, enlarged "C" furnace, new ore bins and gas cleaner at blast furnaces. Pipe straightening machine for buttweld threading floor. New power transmission lines. Extension of No. 1 machine shop and additional machine tools. Extension to employment office building.

Struthers Works: New straightening and cutting-off machine at rod and wire department.

Indiana Harbor Works: Automatic control on Nos. 4, 5 and 6 open hearths, mold handling facilities and skull cracker building for bessemer and open-hearth departments. Lead fume exhaust system at bessemer department. Vertical edging and coiling equipment at No. 10 skelp mill. New buttweld mill, exhaust system in galvanizing department at tube mills. Three resquaring

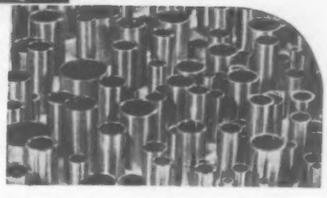
SLEEVE BEARINGS



any TYPE

any SIZE

any QUANTITY



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And size is no handicap. As small as jewelry — as large as sewer pipes, our facilities are complete in every respect.

Whether you order 1; 100; or 1,000,000, makes little difference. We attach the same sense of responsibility, the same exacting treatment to every order. As manufacturers of every known type, we can give you competent bearing advice free from prejudice. Why not try Johnson Bronze?

JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

550 S. MILL STREET • NEW CASTLE, PA.

shears, new 5/16-inch shear line and relocation of equipment on ⅝-inch shear line at hot strip mill. New plate counting machine, two loading tractors, immersion heating and automatic temperature control on four tin pots, extension of bosh handling and tractor shop buildings and assorting room and warehouse, new 4-chambered annealing furnace at tin mills. Electric furnace in metallurgical laboratory, dust cleaning equipment and soot blowers in steel plant boiler house.

Underway

Brier Hill Works: Fireless steam locomotive.

Campbell Works: Ladle transfer pit and two 150-ton mixer type hot metal cars at blast furnaces. Hot scarfing equipment at blooming mill. Additional roughing stands and flying shear at billet mill. Three lathes and power hack saw at No. 1 machine shop.

Struthers Works: Equipment for drawing high-carbon copper coated wire, electric patenting and oil tempering furnace, six wire drawing machines at wire mill. Additional roughing stand and new drive for roughing mill at rod mill.

Indiana Harbor Works: Dolomite machine at open hearth. Equipment for hot scarfing billets and slabs at blooming mill. Looping floor, coupling bins and heating system at buttweld tube mill. Hot saw and tables and welder for coiled rods at merchant mills. Palm oil reclamation system, three pin-hole detectors on shear lines, plate pilers for 19 tin pots and three tractors at tin mill. Third high-pressure boiler at steel plant boiler house.

WHEELING STEEL CORP.

Completed

Martins Ferry Works: New warehouse and shipping building.

Steubenville Works: Alterations, additions and improvements to 45-inch slabbing mill and 60-inch hot strip mill to increase speed and provide for rolling wider widths. Additions and improvements to new process mill to enable it to finish materials of a wider width than produced on hot strip mill. Installation of modern benzol refining equipment to replace obsolete equipment at by-product department. Four additional lines of galvanizing equipment.

Marine Department: New diesel towboat and 14 steel hopper barges.

HENRY DISSTON & SONS, INC.

Completed

Additional electric annealing furnace, new hot saw at 12-inch bar mill, addition to melt shop for alloy storage, hot top brick manufacture and wash room facilities, extension to hammer shop building, new 3-ton hammer and four oil fired furnaces, cold cut-off saw, magnaflux inspection, macro etch testing, building for storage of refractories and spare parts, extension to yard crane runway and substation enlarged.

Underway

Extension to melt shop, new 25-ton crane and other changes and improvements which will more than double ingot capacity, two electric annealing furnaces, enlargement of substation, new central boiler house with 600-pound boilers of 175,000 pounds steam capacity per hour using pulverized coal.

INLAND STEEL CO.

Underway

Indiana Harbor: Four additional tin pots and extension to tin mill building to provide for additional tin plate capacity. At the 46-inch blooming and slabbing mill: extension to soaking pit building, six additional circular soaking pits and two waste-heat boilers to provide additional heating capacity for slabbing mill. At main laboratory in plant II: extension to main laboratory building and additional laboratory equipment.

AMERICAN ROLLING MILL CO.

Completed

Hamilton Works: Enlarged No. 2 stack from 13½ to 18-foot hearth; daily output increased from 350 to 700 tons.

Butler Works: New soaking pit.

River Transportation: Towboat S. S. THORPE, purchased and rechristened the GEO. M. VERITY, for transporting coal between rail terminals at Huntington and Cincinnati for use in Middletown plant and to replace contract towboats.

Underway

Hamilton Works: Enlarging capacity of ore yard to provide for storage of an additional 100,000 tons. Installing a 60,000 cubic foot turboblower.

Middletown Works: New soaking pit.

GRANITE CITY STEEL CO.

Completed

Granite City: One electric annealing furnace.

Underway

Granite City: Annealing furnace and roll grinding equipment.

CENTRAL IRON & STEEL CO.

Completed

Extension to open-hearth pit building including two 25-ton overhead traveling cranes. Sunken pouring pit for teeming high-grade steels provided. Steel leanto building at open-hearth department for brick storage, forge shop and electric shop. One 100-ton open-hearth ladle. A 20-ton crane and multiple punch installed in flanging department. Knife block with magnetic hold-down installed on shear in 126-inch plate mill. Crane runway and 25-ton crane installed over rolls and engine of 126-inch plate mill. Runway and crane installed in steel yard to handle steel by magnet for the 126-inch sheared and 42-inch universal plate mills.

Underway

Two fire tube waste-heat boilers at the 126-inch plate mill are being replaced with modern fire tube units. One 75-ton open hearth is being rebuilt to make low-alloy steels.

MIDVALE CO.

Completed

Two forging presses, five heating furnaces and six heat treating furnaces.

HACKNEY FACILITIES SOLVE PROBLEMS IN MANY INDUSTRIES

HACKNEY manufacturing facilities have played an important part in the solution of numerous problems in many industries. As a result, a number of manufacturers have been able to effect product improvements and at the same time to reduce their costs.

This deep drawn liquid receiver is one of the several special products manufactured by Hackney for the refrigeration industry. It is suitable for 250 lb. per sq. in. working pressure. Note that the vessel is equipped with two bull's-eye fittings which consist of ground glass inserts of approximately ½" thickness. They are held in place by special gaskets and with a brass ferrule retainer. With these bull's-eyes, it is a simple job to gauge the amount of liquid refrigerant in the receiver.

In availing themselves of Hackney design and manufacturing facilities, manufacturers get the benefits of Pressed Steel Tank Company's more than 35 years' experience in the manufacture of special shapes and shells from many types of metals. Through positive control of heat treatment, X-ray control of welding and numerous other Hackney procedures, they are assured of better, more dependable products at lower costs. Whatever industry you are in, you may find Hackney's facilities beneficial and profitable. A Hackney engineer will be glad to cooperate with you in developing new shells or shapes or improve on those now being used. There is no obligation—write for details.

PRESSED STEEL TANK COMPANY

Hackney MILWAUKEE

1387 Vanderbilt Concourse Bldg. NEW YORK
208 S. LaSalle St., Room 1511 CHICAGO
1461 S. 66th St. MILWAUKEE, WIS.
688 Roosevelt Bldg. LOS ANGELES, CALIF.

Containers for Gases, Liquids and Solids

Underway

Two acid open-hearth furnaces, one electric furnace, new machine shop and new heat treating building.

JONES & LAUGHLIN STEEL CORP.

Completed

Pittsburgh Works: Coal washer, sulphate drier, coal storage yard and crude pyridine plant; relined two Eliza blast furnaces.

Aliquippa Works: Blooming mill tables; repair-stand and crane at bessemer plant; additional tin plate, seamless tube and wire finishing equipment.

Miscellaneous: Steel drum line at Bayonne, N. J. barrel works; new steel drum plant, Port Arthur, Tex.; 150 quarry cars for Blair Limestone Co.; 25 steel gondolas, Monongahela Connecting Railroad Co.

Underway

Pittsburgh Works: Phenol recovery plant, two air-conditioning units and rehabilitation of stockhouse bins at blast furnaces; 200-ton stripper crane; four strip annealing furnaces.

Aliquippa Works: Air-conditioning unit for blast furnace; additional wire warehousing capacity.

Miscellaneous: 250 mine cars and 30 coal barges, Vesta Coal Co.; 25 steel gondola and 30 hopper cars, Aliquippa & Southern Railroad Co.

MISCELLANEOUS

Superior Steel Corp., Carnegie, Pa.: New annealing furnace.

Sharon Steel Corp., Sharon, Pa.: A new installation is now building for coating strip up to 22 inches wide with various coatings such as copper, zinc, lead, etc.

McLouth Steel Corp., Detroit: Completed building annex for housing a new annealing furnace and three additional annealing bases.

Timken Roller Bearing Co., Canton, O.: New 100 x 275-foot forge shop, 65 x 300-foot mold conditioning building and 105 x 105-foot melt shop addition at its steel and tubes division. Box factory, tube storage and bearing factory addition at Gambrinus division. Building to house hospital, canteen and employment rooms at Columbus division. Floor space of 4600 square feet being added at Mt. Vernon rock bit factory. Truck loading dock at Canton bearing division. Foregoing construction is underway.

Wickwire Brothers, Cortland, N. Y.: Added a Wellman anthracite gas producer, Wilson wire annealers and five continuous wire drawing machines. A second Wellman anthracite gas producer is now being installed.

Worcester Pressed Steel Co., Worcester, Mass.: Added to press department a 300-ton triple action hydraulic press for deep-drawing stampings and other equipment.

Clayton Mark & Co., Chicago: Added a percussion electric welding unit. One direct-current welder for tubing from 1 to 3 inches diameter being added.

Latrobe Electric Steel Co., Latrobe, Pa.: Heating and annealing furnaces costing about $200,000 were added; others are under construction.

Colorado Fuel & Iron Co., Pueblo, Colo.: Installed facilities to manufacture and warehouse welded reinforcing mesh and built a new creosote recovery plant at coke works. Plan to replace one blast furnace and install facilities for making 155 millimeter shells.

Atlantic Wire Co., Branford, Conn.: Installed two 6-block wire drawing frames and a new straightening and cutting machine.

Blair Strip Steel Co., New Castle, Pa.: Various improvements at a cost of $40,000 were made.

Rotary Electric Steel Co., Detroit: Miscellaneous improvements amounting to $137,000 were completed.

Braeburn Alloy Steel Corp., Braeburn, Pa.: Installed preheat and final gas-fired furnaces and a gas-annealing furnace.

Washburn Wire Co., Phillipsdale, R. I.: Miscellaneous construction costing $300,000 completed in 1940. Additions underway to cost $300,000.

Pittsburgh Steel Co., Pittsburgh: Installed six soaking pits and new wire cleaning plant.

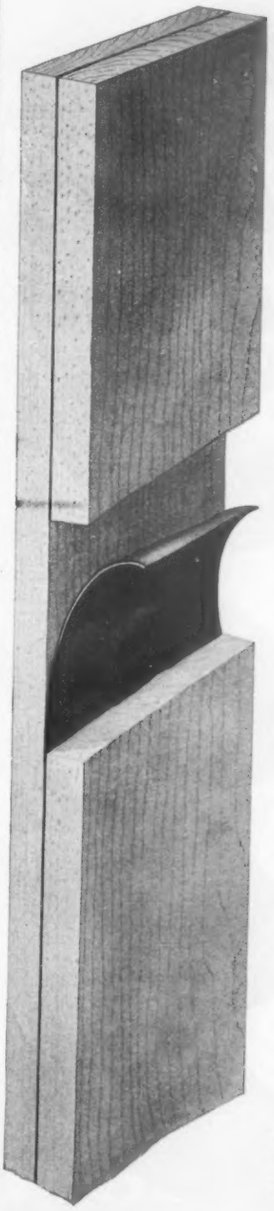
Laclede Steel Co., St. Louis: Increased building capacities in blooming, wire, tube mills and fabricating shop; increased heating capacity on 10-inch strip mill; wire drawing and annealing capacities and tube finishing capacity increased; all at Alton works. New cafeteria completed at Madison works.

Allegheny Ludlum Steel Corp., Pittsburgh: Additional electric furnace melting capacity of about 50,000 tons of alloy steel annually under construction. Further expansion under consideration.

Steel Plants To Buy Heavily

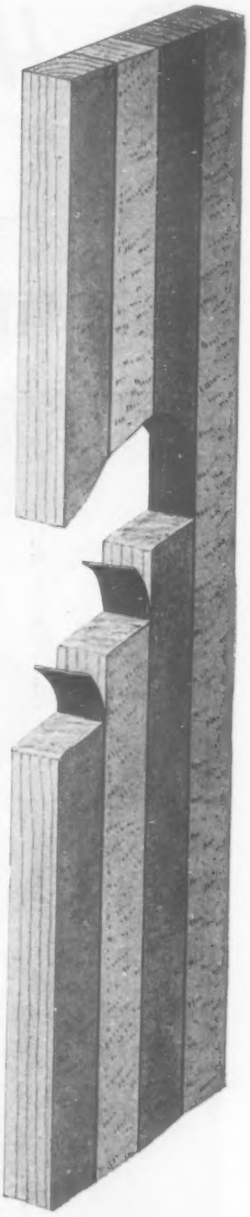
■ ANALYZING existing factors it seems certain that the steel industry will be a heavy buyer of maintenance equipment and materials all through 1941. All present signs indicate that steel production will be at or close to capacity all through the year, meaning that parts and maintenance materials will have to be replaced in volume considerably above normal. This will be reflected in every department, from mines to finished steel shipping departments.

The steel industry all through the year will be a ready market for almost any item that will permit increased production. This would cover such devices as new or improved controls, new or improved equipment for mechanizing work—anything that would make



DETROIT "SAFETY" DROP-HAMMER BOARDS

We have been building hammer boards for over 40 years; this is our only product. The TWO PIECE BOARD shown on the left consists of two pieces of straight grained, hard maple with a leather insert between. The leather acts as a cushion and holds the strips firmly together. The STRIP BOARD shown on the right consists of from four to six strips of hard maple glued together with leather inserts between. Wear on this board is on the end grain. WARPING is eliminated, and, as with the TWO PIECE board, the leather holds the boards together in case of breakage. The popularity of both boards is about equal, with the STRIP BOARD seeming to have the edge. We suggest you test both, and then settle upon the one that gives you the best service. We can also supply SOLID HAMMER BOARDS, PINS, and HAMMER HELVES built to your specifications.



THE DETROIT DROP-HAMMER BOARD CO.

3824 GRAND RIVER AVE.

DETROIT, MICHIGAN

for greater efficiency of production.

The year 1941 seems slated, also, to reflect much rounding out in capacity. This trend, under way in the second half of 1939, seems certain to be reflected for a considerable period ahead. It is expected that the number of soaking pits will be further increased, that additional mills will be equipped for greater operating speeds, that rolling widths of hot strip mills in additional instances will be enlarged.

With respect to buying in connection with additional expansion in steel making capacity the outlook cannot be charted clearly. At present there are two schools of thought on the subject of expansion. In some circles, mainly in government, it is the opinion that steel capacity should be expanded, perhaps about 20 per cent. In industry itself, however, all recognized spokesmen hold that the present capacity is ample. They say that the best estimates indicate that the national defense program as now planned will not take more than 6,000,000 tons of ingots in any one year, that British and Canadian requirements call for not more than 10,000,000 tons of ingots a year, that nonbelligerent export markets will not take more than 2,500,000 tons per year. On a basis of 83,000,000 net tons, the present capacity, this would leave 64,000,000 tons available for civilian demands. The steel industry thinks this means plenty of steel to go around. It is averse to building capacity up to an unnecessarily high level and thus invite chaos when the defense effort begins to taper off.

Industry leaders recall all too well the expansions of the first World war and the subsequent headaches of idle capacity. This they are reluctant to repeat.

Additional future expansion, therefore, will depend to a considerable extent on what the government demands and what it is willing to pay for. It may be that some additional expansion may be demanded for the simple reason that such expansion programs as recently have gotten under way represent an increase of a little more than 1 per cent in the nation's steel output whereas, as stated above, there is a very definite demand in some influential government circles for a 20 per cent expansion.

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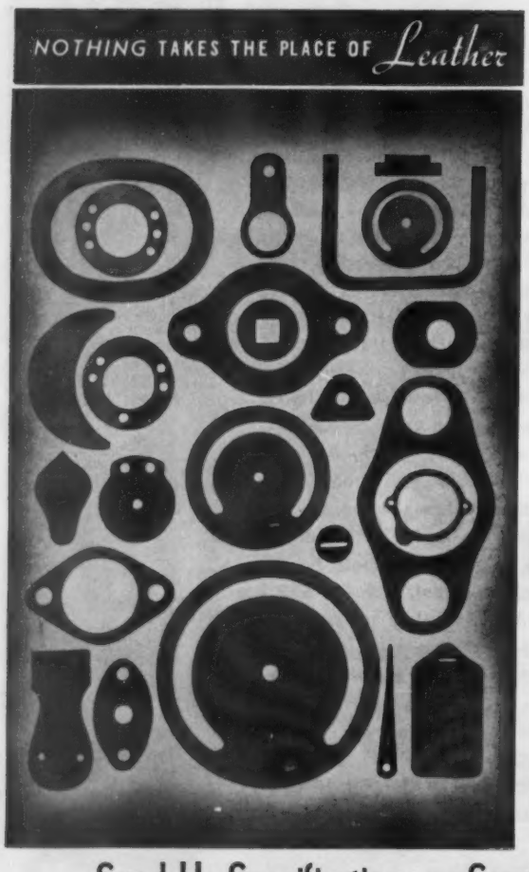

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Machine Tools

(*Continued from Page* 199)

hood of 90,000 and is still going up. Trade and technical schools have been combed for every likely prospect, and apprenticeship courses, which to a considerable extent had lapsed during the depression, have been revived.

All that, however, is a mere drop in the bucket. The bulk of the increase has been and is being brought about by careful selection and quick training in certain skills of young men who previously have had no experience at all in machine tool building. Wonders are being accomplished in quick training by letting these apt learners, in small groups, watch and work with skilled and experienced men.

In this manner, and with the help of a certain amount of classroom work in some cases, the demand for workmen is being met faster and more effectively than even the most sanguine observers believed possible a year ago. As far as the American machine tool industry is concerned, the youth of this country is giving proof that "it has what it takes."

The machine tool industry during this emergency has for the first time in its history taken full advantage of the machines which are its own products. Not only have quantities of obsolete machines finally been rooted out of machine tool plants but also—since the start of the na-

tional defense program—somewhere in the neighborhood of $40,000,000 worth of new equipment of the latest type has been installed. Included are many special machines for quantity production of repetitive parts such as milling machine tables. No longer is any other industry justified in saying to the machine tool industry, "Physician, heal thyself!"

This new, high-production equipment in part has solved the problem of manufacturing space. Although some building of plants has had to be done, it has been held down as much as possible by resorting to other expedients such as conversion of storage space to manufacturing purposes, rearrangement of equipment for great efficiency, and "farming out" of work.

The machine tool builders are showing good common sense in this matter of "plant." Recalling overbuilding orgies of the past, they strive for peak efficiency in existing buildings, including hired or purchased added space, before resorting to the costly use of brick and mortar.

The conclusion to be drawn is that as fast as machine tools can be "digested" into the national defense production setup and even faster than men can be trained to operate them, the American machine tool industry will deliver them. This industry is not, nor will it ever be the "bottleneck" in national defense. It is our first line in defense—and a thoroughly dependable first line at that.

Demand Rises For Tools, Dies

■ AFTER machine tools the next most critical situation in the armament program exists in the tool and die industry—a point whose significance just is beginning to be fully understood. For instance, it is estimated that the defense program will require at least $16,000,000 worth of gages alone in 1941. Vast quantities of tools and related items will be required for the production of all sorts of munitions, as well as peacetime products, and they must be at hand before production can begin.

Tool and die shops throughout the country are extremely busy, many of them operating on a 24-hour basis. An exception is to be found locally at Detroit. There the tool and die industry has grown up with the automobile industry and, naturally, is inclined to "wait on" that industry as its chief customer and means of support. Recently it has been confused as to what its immediate course shall be; on the one hand it has begun to be subjected to pressure to swing its full facilities behind the defense program while on the other hand it does not wish to lose standing with automobile companies who have not yet announced 1942 model details. It also hesitates to fill up with work with which it is not too well acquainted.

In the aircraft and aircraft parts industries, now working at breakneck pace, a spectacular demand for a wide variety of jigs and fixtures is foreseen, particularly in view of the half-billion dollar aircraft parts program launched in Detroit which is enlisting the aid of the tool, die and fixture industry.

Dies, in the automotive sense of the word, are not applicable to aircraft production as yet, because of the limited production involved and overly high cost of automobile-type tooling on limited runs. However, many different types of dies are required in aircraft work, most of them at present being either the zinc and lead type or some of the newer nonferrous mixtures cast to shape and requiring little finishing.

Automotive tool and die shops are entirely unfamiliar with this

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type of work and some are hesitant over taking it on because of the many unknown factors involved. However, as far as jigs and fixtures are concerned, these shops are well versed in their construction and by June a large quantity of jig and fixture work for aircraft assemblies should be making appearance.

Many presently-used aircraft jigs and fixtures are of hard wood. Increased production demands should see most of these changed over to welded steel, for greater accuracy, ruggedness and also much lower cost.

Defense Speeds Construction

■ CONSTRUCTION, first industry to reflect defense program needs in steel, lifting orders for fabricated structural material to approximately 1,700,000 tons last year, will continue to require large tonnages through 1941.

Large volume of steel for defense building is yet to be placed and a flow of tonnage to fabricating shops well into the first half is assured. The first six months this year will exceed that for the same period, 1940. Bulk of defense construction steel tonnage did not materialize until the second-half last year. With heavy volume assured during the next six months, under normal conditions, it might be assumed the last half this year will reverse the trend and that the structural steel peak would be passed by July 1.

However, uncertainty as to future events, possible increased activity by the United States in the war, and many other unforeseen developments may easily carry structural steel demand through the entire year at a sustained or accelerated rate.

Structural steel shops started the new year with more than 600,000 tons on books for future fabrication. This will not be materially reduced for some weeks.

Annual fabricating capacity is 4,000,000 tons, which might be further increased by utilizing some idle plant facilities; structural rolling capacity is 5,205,300 tons. Thus, the fabricating industry is well qualified to handle all prospective tonnage for defense, industrial and all plant expansion likely.

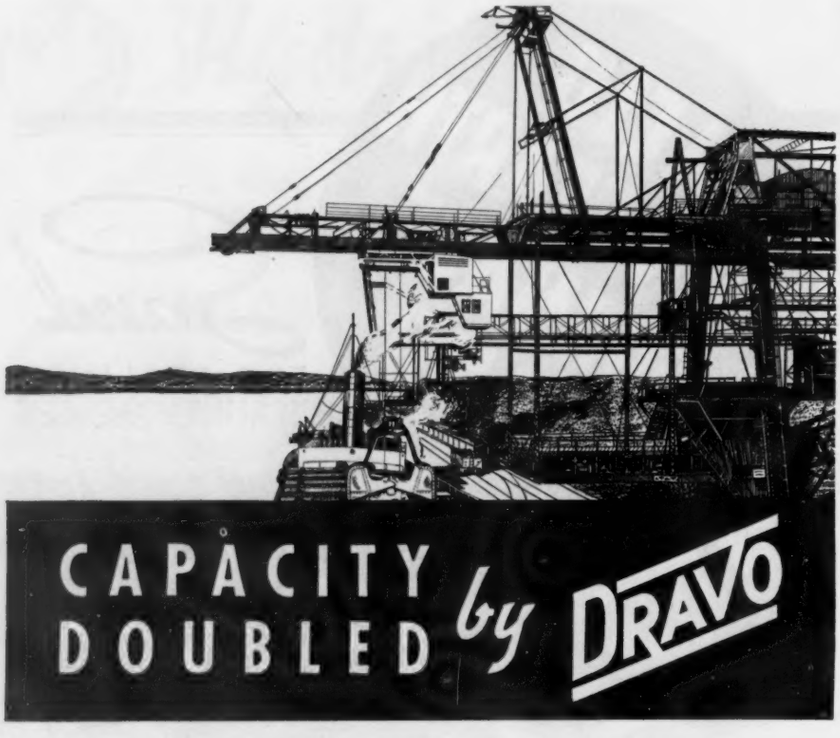
To iron out congestion and temporary bottlenecks, however, wider distribution of contracts and a more even flow of tonnage is desirable. Under stress of the time element, the latter is difficult, fabricators being subject to delays and handicaps in obtaining completed plans and designs. Delays in deliveries are

Structural Statistics

(Reported by American Institute of Steel Construction)

	Bookings 1940	1939
January	81,689	101,712
February	98,882	82,719
March	128,321	95,065
April	73,780	118,309
May	126,815	156,848
June	109,744	111,594
July	194,940	114,056
August	122,468	100,849
September	225,494	121,357
October	233,115	118,841
November	†135,000	99,316
December	†150,000	84,383
Total	†1,680,248	1,305,049
	Shipments	
	1940	**1939**
January	110,919	84,281
February	97,157	84,412
March	95,915	125,259
April	116,317	120,943
May	115,617	125,818
June	119,087	130,114
July	127,120	110,473
August	134,858	139,680
September	142,834	140,828
October	139,221	133,849
November	†150,000	128,231
December	†150,000	116,166
Total	†1,499,045	1,440,054

†Estimated.



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● Whether the problem is one of modernizing old equipment, replacing obsolete handling machines or designing special facilities to meet new problems, consultation with Dravo Corporation may prove to be of great value to you. Added to its ability to fabricate and erect, design and put into commission ideas as shown above, Dravo Corporation has had years of experience building docks, retaining walls, plant foundations—everything that enters into the problem of terminal facilities. Bulletin 403 describes mill foundations and terminal equipment. Bulletin 202 describes revolving cranes. Either will be sent on request. Inquiries relative to specific problems may be addressed to

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due to this situation and to concentration of orders. As to the wider spread of tonnage, progress is being made in this direction by standardization of structural defense units. The fabricating industry as a whole is not operating much above 60 per cent of capacity, although there are some shops on a 100 per cent basis.

Most apparent lag is in placing steel for negotiated cost-plus-fee contracts. Many of these were awarded in conjunction with engineering work, and designs and plans must be completed before contractors submit data to steel shops for estimates. This takes time, but on the whole, considering the speed required, progress is satisfactory and steel for such contracts is reaching fabricating shops in heavier volume. Substantial number of such contracts were placed for cantonments which require little structural steel, but large quantities of pipe, reinforcing, nails and miscellaneous steel. Incidentally, work on some cantonments is behind schedule.

Shipyard Demand Heavy

Expansion of shipbuilding facilities looms as a major outlet for structural steel. Practically every shipyard in the country, including the navy, has large construction programs under way. Additions, shipways, shop buildings and miscellaneous fitting structures took 155,000 tons last year. Work remaining on the boards indicates even more will be required in 1941. Several long inactive yards are being refitted for shipbuilding. Outstanding is the return to the active list of Cramp Shipbuilding Co., Philadelphia, requiring additional ways, outfitting piers, machine and pipe shops, other buildings and cranes.

Under the two-ocean navy program there are now 330 war vessels under construction or contract while the maritime commission's 500-ship, 10-year program, started several years ago is being expedited. Already 150 keels have been laid, 75 launched and 51 actually delivered. Add to this the efforts of the British to purchase and construct ships here and it may readily be seen that tremendous immediate expansion of shipbuilding facilities is required.

In addition to fabricating the mounting volume of structural steel needed for expanding shipbuilding facilities, the structural shops will probably play an increasingly important role in fabrication of the ships. These vessels are needed now and early delivery will be a paramount influence on the success of the entire defense program, involving both the United States and Great Britain.

To expedite construction, parts of these ships will be produced by structural steel shops for assembly at coastal points. Details are being worked out and volume is likely to develop in time to take up part of the slack expected with the passing of the peak in the regular construction program, probably in June-July. Structural shops affiliated with shipbuilding units already are assisting sister subsidiaries in the fabrication of ship parts.

Several dry docks will be built and steel has been placed for two at Philadelphia and Norfolk, Va.

Expansion by the aircraft industry has been phenomenal. Facilities for the assembly of planes will have increased several hundred per cent by May.

For hangars, air base facilities and miscellaneous servicing structures, contracts have totaled 100,000 tons. For some months the latter group appears to be the most promising for continued extensions. A large number of portable hangars will be purchased by the government, bids already being in on the first group of 72. Municipal airports, directly linked with army and navy programs, will be erected in large numbers, all needing hangars and other buildings.

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machine tools, having increased 50 per cent in the last year, will be continued, although probably at a somewhat reduced rate. Growth in machine tool production is partly due to new building and also to additional equipment and rearrangement of plant. Forging shops will account for some additional structural tonnage this year.

The steel industry will expand moderately, probably taking more structural steel than last, although few large shop and mill building projects will go forward. Exceptions are new mill buildings for the concentration of production at the Worcester, Mass., South works by the American Steel & Wire Co., the Bethlehem Steel Co., program for additional open hearth, coke and miscellaneous capacity. Moderate needs for finishing, fabricating and electric furnace extensions will develop in other areas.

Bridges and public works of a nondefense type will be curtailed, although several larger bridge projects under consideration will go ahead and some may develop in connection with defense. Generally speaking, some increase may be expected in the first half for army, navy, air corps, defense industries and defense housing. To date, the navy program is well ahead of that of the army.

Increased employment and consequently higher purchasing power with larger national income may tend to increase private building in several directions: Commercial, residential, manufacturing buildings and some electric utility construction.

Demand for power is near a peak in some areas and utilities are considering larger expenditures for plant and equipment.

Factors to be considered as possible brakes on expected private construction and engineering projects involve advances in building costs curtailing volume of moderately-priced structures which would ordinarily be in strong demand, and possible limitation of construction industry facilities for a much enlarged private program on top of the expected needs for defense.

Because the industry has not been operating anywhere near capacity in the last decade temporary local shortages of skilled labor are possible. However, it appears unlikely private work will be long delayed or abandoned because of priorities given defense projects.

Building costs are up slightly and may rise further. Slightly better prices for fabricated structural steel have been obtained in recent weeks, but are still a minor factor in higher costs. Low prices, fostered by keen competition due to over-capacity are still the weak point in the fabricating industry.

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Great Expansion In Aircraft

■ TREMENDOUS expansion is under way in the aircraft industry, as builders strive to attain a productive capacity of 50,000 combat planes per year. Peak output of military planes, until 1939, was slightly more than 1000 per year while current rate is about 12,000 per year.

Contracts for new plants and additions since Jan. 1, 1940, total $318,125,434. Facilities already in operation represent $83,356,580 of this sum. Those represented by the remaining $234,768,854 are to be in operation by June, 1941.

The industry's payroll of shop employes increased in 1940 from 60,000 to more than 165,000. When construction under way is completed and the industry reaches its peak in June or July, estimated airplane factory personnel will exceed 380,000. Reports indicate total engaged in fabricating aviation equipment,

including subcontractors' employes, will be nearly 500,000. Despite skilled labor shortage, many plane builders appear confident current training programs will provide adequate supplies of sufficiently skilled workers to maintain proposed production schedule.

Increase in productive floor space last year was from 11,983,896 square feet to 22,530,988. Additional 22,635,190 square feet under construction will bring the industry's total to 45,166,178 square feet by June. Production in several new plants is scheduled to start early in 1941, with all to be in operation by mid-year.

Backlog, as of Nov. 1, 1940, aggregated $2,831,665,159, compared with $675,432,475 Dec. 31, 1939. Original aircraft building program was for 35,800 planes, Britain to receive 14,300. Late reports indicated additional 32,000 will be required, with 12,000 for Great Britain. Deliveries last year were expected to exceed $625,000,000, against $225,000,000 in 1939, best previous year. In 1938, deliveries totaled about $130,000,000.

To expedite plane production, provision has been made to subcontract a wide variety of parts as wings, tail groups and fuselages to automobile builders and other manufacturers. Automobile industry has already taken specific steps to organize an efficient parts-making program. Final assembly, however, will be left to experienced plane builders.

To Build Plants in Mid-West

Government is planning construction of at least two large final assembly plants in mid-west. Located at Omaha, Nebr., and Kansas City, Mo., in accordance with federal policy of placing defense plants in the interior, the assembly units will be operated by Glenn L. Martin Co., Baltimore, and North American Aviation Inc., Inglewood, Calif., respectively. Title will remain with the government. The two plants will turn out about 2400 medium two-motor bombers per year. Two more plants, to produce 1200 four-motor bombers annually, are contemplated, with Lincoln, Nebr., Tulsa, Okla., and Detroit listed as possible sites. Reports indicate many more final assembly plants may be constructed in near future, as automobile industry begins to produce aircraft parts in large volume.

Many in the industry feel assistance of manufacturers who have had no connection with aircraft fabrication is to be welcomed. Applying particularly to the automobile industry, extensive subcontracting appears a means whereby unhealthy over-expansion in the aircraft industry may be avoided. Straight line production methods as exemplified in automobile building, it is believed, can hardly be duplicated. More general adoption of standard parts and models, however, is seen as partial solution to increased production. Hence a constant widening of the utilization of facilities not now devoted to aircraft production appears probable.

Engine shortage is currently placed at 300 per month, with total production estimated at 2400 monthly. Average of two and a half engines is required for each ship, with more needed as spares and replacements. Most serious shortage appears to be in high-power motors for combat planes. Engine production is not expected to come abreast of frame output for many months.

Planned expansion, calling for new equipment purchases, was deferred by the nation's air transport system last month, that the rearmament program might be expedited. Defense priorities board adopted a policy, agreed to by airlines, permitting the latter only replacements for existing equipment. New equipment, to have been used in expanding service, will not be delivered until military needs are less pressing. Restrictions imposed are not

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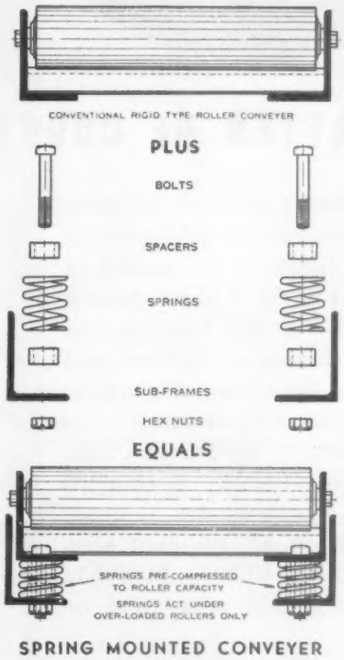

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CONTINUOUS FLOW PRINCIPLE OF HANDLING MATERIALS

expected to hamper greatly normal growth of air transportation in 1941.

Reflecting sharp expansion in commercial air carrier activities in first nine months last year, domestic civil aircraft production for the period totaled 4543 units, 69.7 per cent more than 2698 aircraft produced in the period in 1939. Production for nine months was 22.3 per cent greater than 3715 units turned out in entire year, 1939. Sharpest gain, on a percentage basis, was in multi-engine heavy planes, used by commercial airlines. Definite trend to heavier aircraft, with more powerful engines, was noted for both the commercial and private interests.

Developments in manufacture of airplanes last year were numerous, with new records for speed and maneuverability established, especially in combat types. Adaptation of new materials was widespread, with use of plastics on a broad scale foreseen in the near future. Most significant trend in manufacture of military aircraft, according to one manufacturer, has been adaptation of designs to the highest tactical efficiency according to lessons learned in actual combat overseas. Designers have been enabled to meet requirements developed by modern air warfare. These specifications include adequate pilot protection, fuel protection, much additional armament, greater cruising range and efficiency at high altitudes.

Commenting on problems facing the industry, Glenn L. Martin, president, Glenn L. Martin Co., Baltimore, said: "The aircraft industry is asked to do in half the time what it took Germany six years to accomplish . . . With the co-ordination of all American industry in the program, we can do the job on time . . . Large scale expansions of facilities are already under way . . . The aircraft industry has long understood mass-production methods and has awaited only large orders to supply them . . . The aid of other industries will be a large factor in success of the effort, not only in supplying materials but in accepting subcontracts for aircraft parts and assembly . . . Sensible steps are already under way to supply trained workers . . . New materials are being adapted to meet shortages. Highly significant is the progress being made with plastics . . . "

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Farmer Buying Power Gains

■ AGRICULTURE, an important consumer of steel and other metals, enters 1941 with prospects for becoming a still larger consumer. Completing a comparatively satisfactory year, the farm industry looks optimistically to another in which recent gains will be not only continued but extended. Only unforeseen and drastic developments at home or abroad throw a shadow across the picture.

As 1939 closed, the farm equipment industry looked for a 10 per cent gain in business for 1940—actually it proved to be about 20 per cent, because an upsurge near the end of the former year carried over with increasing momentum. And now conservative estimates are for a 10 per cent or better improvement in the coming year.

Domestic farm equipment sales, estimated at $492,000,000 for 1940, were best since the record $507,000,000 in 1937, and compared with $410,000,000 in 1939. Small tractors and implements introduced to meet requirements of smaller and medium-sized farms aided the sales increase. Exports, down in 1939, improved last year to the best since 1930 when large Russian orders were filled.

Crops in 1940 appeared to be second only to the record production in 1937. Total acreage was about 7

per cent below predrouth level and smallest since 1915, but average yields were more bountiful than in any year except 1937 and aggregate tonnage was 6 to 7 per cent over predrouth average.

Cash farm income in 1940 was well sustained at an estimated $9,050,000,000, best since 1929 with $11,221,000,000, and well distributed over the country. Government payments, an important factor in farm income the past two or three years, aggregated $750,000,000 last year, against $807,000,000 in 1939.

It has been demonstrated that only when farm income has a buying power over $6,000,000,000 can the implement industry market its products in profitable volume. Buying power in 1940 of $7,400,000,000 was $360,000,000 better than in 1939, and $70,000,000 larger than in 1929. Cash income is governed by (1) volume of marketings and (2) prices received by farmers for their products, while buying power is governed by cash income adjusted to prices farmers pay for commodities and services used for living and production purposes. Government payments also are a factor.

First two factors produce "cash farm income," while prices paid by farmers determine volume of goods and services farmers can buy with their income. Sales records of industries which supply farmers indicate that their volume follows closely ups and downs in buying power of farm income.

Farm Cash Income and Buying Power

(Millions of Dollars)

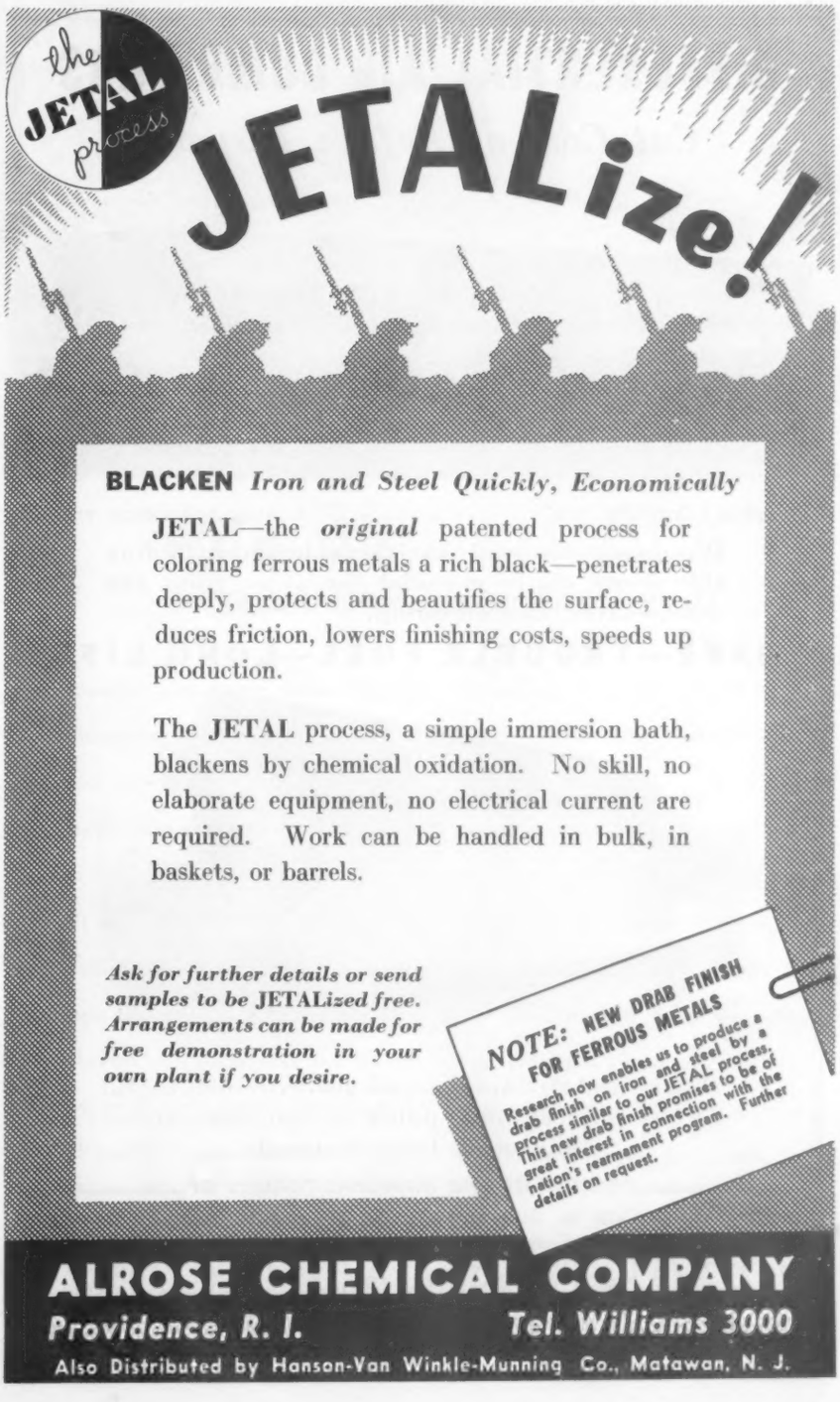
	Cash Income From Marketings	Cash Income From Government Payments	Buying Power of Cash Income*
1929	$11,221	....	$7,330
1930	8,883	....	6,120
1931	6,283	....	5,070
1932	4,682	....	4,370
1933	5,278	$131	4,950
1934	6,273	447	5,460
1935	6,969	573	6,030
1936	8,212	287	6,850
1937	8,744	367	7,000
1938	7,599	482	6,630
1939	7,711	807	7,040
1940**	8,300	750	7,400

* Includes government payments.
** Preliminary estimate.

Cash farm income in 1941 is expected to be higher than last year and may be highest since 1929, according to department of agriculture forecasts. Better domestic demand, smaller exports, and moderately higher farm prices are in prospect, assuming continuation of war. With average weather, volume of agricultural production is expected to be about same or only slightly less than 1940. Government payments will continue and government loan programs will be advanced by higher loan bases.

Increased income will be partly offset by higher production costs. Defense endeavors and higher industrial activity will tend to raise prices for goods and services used by farmers. Farm wage rates, building materials, automobiles, farm machinery and fertilizer may be higher, but the agriculture department states income probably will increase more than costs so that farmers will be able to pay for more improvements in farm plant and better level of living than in 1940. Even allowing for higher prices of goods farmers use, buying power of spendable farm income probably will be at or close to the best level in 20 years.

Equipment sales, it is estimated, will be about 10 per cent larger in 1941 than 1940. This is predicted on the more favorable economic position of the farmer, current trends, and national defense influences. Internal changes are taking place in agriculture, probably the most important being in the South. From one principal crop—cotton, and for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which acreage is being reduced—the southern agrarians are turning to diversification, such as raising and feeding of live stock and the planting of corn on which there is no restriction.

The South, therefore, is buying more equipment, particularly one-plow tractors suited for 55 to 90-acre farms.

National defense program is expanding employment in urban districts, with a two-fold effect on farmers; first, stronger consumer markets will develop, and second, boys will be leaving the farm for industrial jobs and military service. Thus will be created a greater need for labor-saving machinery.

Export outlook for farm equipment is unfavorable, except with respect to Canada. War in Europe has shut off the market for American implements and crops. South America, particularly Argentina, has lost its foreign markets and consequently has only a restricted ability to buy equipment. The favorable domestic situation, however, is expected to offset loss in exports.

If we now combine prospects for agriculture in 1941 with significant trends developed in the industry during recent years and now clearly evident, it is possible to get a rough appraisal of steel and metals requirements. Not only will consumption increase, but there will be shifts to newer and stronger alloys and shifts from one form of material to another.

In 1940, the agricultural implement industry used more iron and steel than any year except 1937 and possibly 1939. Many new items caused a wider use of flat-rolled steel, notable examples being combines and stationary threshers. At the same time, there were numerous replacements of wood with steel.

Lower-priced tractors and implements—becoming more popular each year— mean larger unit sales, therefore larger iron and steel consumption, but not necessarily larger money sales volume. These units accounted for much of the 1940 volume and will continue to do so this year. The one-plow tractor represents better than one-third of all wheeled tractors in domestic sales. There is also an increasing demand for tracklaying tractors.

Electric Appliance Sales Gain

Since an estimated 1,786,000 farms, or one of four, had high-line electric service at the start of 1940, total number served by power companies probably had passed the 2,000,000 mark by year's end. A large part of this gain is due to the rural electrification administration program. This increase in electrified farms and the fact that average consumption of power per farm is increasing—8 per cent in 1939—is making a rapidly expanding rural market for comfort-creating or income-producing electrical appliances.

One can only conjecture at the amount of ferrous and nonferrous metals to be fabricated into hand irons and ironers, radios, washing machines, refrigerators, toasters, vacuum cleaners, hot plates, water systems and pumps, motors, cream separators, coffee makers, milking machines, brooders, ranges, bathtubs and showers, toilets, septic tanks and electric fences for farms.

Among other growing trends which bespeak increased use of steel on farms should be mentioned construction of houses, barns and other structures, mostly of prefabricated steel types using considerable amounts of sheets and strip; storing of surplus grain in containers of galvanized sheets; laying out of smaller fields, requiring more fencing; and the movement toward freezer-locker plants, lockers for which are fabricated from sheets and light bars. The latter movement for preserving and storing food products constitutes one of the outstanding changes in rural life in the last few years. Department of agriculture states there were 1269 freezer-locker plants in 1938, 1861

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Dumps automatically to either side—down folding side doors chute material far away from the track—saves labor on dump.

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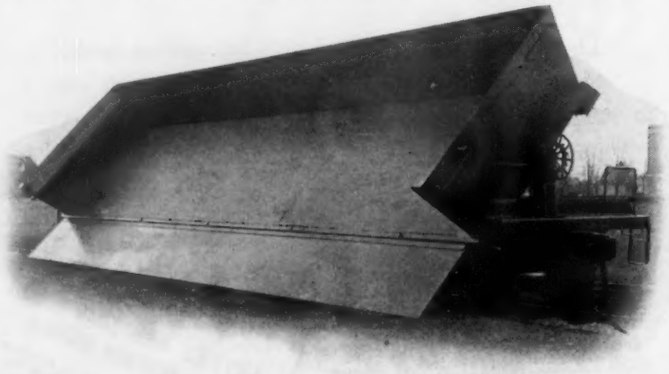

Differential air dump cars are also extremely useful for economical stock piling of coal, coke, stone, and other loose materials.

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in 1939; last year there were 2870.

Technological changes in farming go beyond the increasing demand for tractors, particularly the smaller units. The small combine, capable of harvesting any seed crop, is virtually revolutionizing harvesting methods and demand for this unit is growing. New machines for haymaking also forecast revolutionary changes. These cut standing grass and prepare it for storage as green silage; the same machines with pickup attachments take cured hay and chop it so that it can be stored in about two-thirds of the space required for unchopped hay. A wider demand also is observed for pickup balers.

If the United States should go on an emergency basis and ration steel, the production of farm equipment and other farm materials might be affected. It is probable, however, that the government would recognize agriculture as a national defense industry.

Arms Program Aids Railroads

■ PROSPECTS for a high rate of industrial operations in 1941 augur well for railroad revenues and for purchases of railroad equipment, materials and supplies. Government defense measures will be felt principally in the traffic incident to heavier production of various manufactured items required by this program, with heavier carloadings also likely to result from improved activity among industries stimulated indirectly by rearmament.

Based on past experience the trend of freight movement and railroad revenue this year may be expected to be followed by a corresponding variation in orders from the carriers for cars, locomotives and the many different materials and supplies required in maintenance of transportation facilities.

Railroads express no concern over their ability to meet any traffic load likely to be placed upon them this year. It is pointed out that despite the brisk pace attained by industry in the fourth quarter of 1940, ample transportation was available, and that what further increase may develop in coming months will be insufficient to place any serious strain on shipping facilities. During the latter part of 1940 the railroads moved as much freight to and through the port of New York as they did when the A. E. F. was in France.

Both the hauling capacity and the terminal capacity of the roads "are ample for needs far beyond any that might be anticipated," according to John J. Pelley, president, Association of American Railroads. "Our equipment is adequate for any demands which can now be foreseen." At the same time he pointed out the importance of the regional shippers' advisory boards' quarterly forecasts of freight car requirements as an aid to meeting future transportation demands.

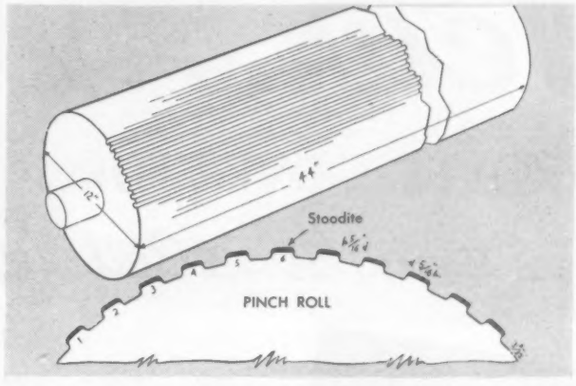
While this situation makes it appear improbable that any further sharp upturn over the recent pace will develop in orders for rolling stock, motive power, etc., during the coming year, it seems likely that the

Railroad Statistics

	Net railway operating income 000 omitted	Freight car-loadings 000 omitted	Freight cars ordered	Steel rail production (tons)
1930	$869,000	45,878	46,356	2,098,021
1931	526,000	37,151	10,884	1,296,681
1932	326,000	38,180	1,968	450,874
1933	474,000	29,220	1,680	466,252
1934	463,000	30,846	24,602	1,131,451
1935	500,000	31,504	19,308	796,921
1936	667,000	36,109	64,523	1,366,228
1937	590,000	37,670	51,611	1,619,228
1938	373,000	30,457	16,303	697,642
1939	589,000	34,103	57,775	1,312,647
1940	*650,000	*36,200	†59,731	**1,325,892

*Estimated; †11 months; **nine months.

PINCH ROLLS HARD-FACED



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improvement of 1940 will be retained if not furthered moderately.

Freight car and locomotive builders are assured of brisk operations this year, partly because they have large orders for armament, such as military tanks, shells, bombs, and similar items.

American Car & Foundry Co. for instance, reported unfilled orders on Oct. 31 of $115,611,801, of which more than $93,000,000 represented uncompleted war work.

Domestic freight car orders last year were near the best volume in ten years. Buying averaged only about 1750 units monthly the first five months but jumped sharply to an average of 8500 the succeeding five months. By November, bookings for the year exceeded the 57,775 cars placed in all of 1939 to approach the 1936 total of 64,523 cars.

The latter was the highest figure since 1939, with 111,216.

Reflecting relatively heavy purchases of freight cars the latter half of 1939, Class I railroads put 59,473 new units in service in the first 11 months of 1940, compared with 20,085 the year before. During the same period the railroads also put 367 new locomotives in service, of which 104 were steam and 263 were electric and diesel. The year before the carriers installed 310 new units, of which 94 were steam and 216 were electric and diesel.

The carriers likewise were active last year in rehabilitating damaged equipment. Whereas on Dec. 1, 1939, there were 158,519 freight cars, or 9.8 per cent of the total, awaiting repairs, these figures were reduced by Oct. 1 to 131,064 cars, or 8.1 per cent. Desire of the railroads is to bring this proportion of damaged units down to about 6 per cent.

Repairing of locomotives cut the number of damaged engines from 6985 on Dec. 1, 1939, to 6276 last Oct. 1. This reduced the percentage of bad-order units from 17 per cent to 15.7.

Rail buying also was stimulated last year by heavier traffic. Production of standard rails alone the first nine months of 1940 totaled 1,219,854 net tons, against 907,695 tons the year before. Part of this increase was furnished by export demand, foreign business accounting for 168,451 tons of last year's nine-month total, against 8772 tons the first three quarters of 1939. It appears probable that rail output for all of 1940 was the largest since 1930, when production of both light and heavy sections totaled 2,098,021 tons.

Moderate Gain in Earnings

Railroad earnings, important regulator of the carriers' spending, showed moderate gains last year. Improvement over corresponding months of 1939 was narrowed as the year progressed, income in September and October falling behind that of the year before. Nevertheless, 1940 net railway operating income was near the best figure since 1930 although about 15 per cent of reporting roads failed to earn expenses and taxes.

Freight carloadings followed a trend similar to that of earnings, holding above the 1939 level until October. The fall seasonal rise in traffic stopped slightly short of the peak a year ago, largely because of a lag in coal movement, and was responsible for the inability of earnings to match their improvement of earlier months. However, net operating income through October was more than 15 per cent ahead of the year before. The increase over 1939 in car loadings for the first 11 months was only about 7 per cent.

■ United States, with 3,065,000 miles of highways has a road mileage nearly three times as great as the total road mileage of England, France, Spain, Portugal, Germany, and Italy combined.

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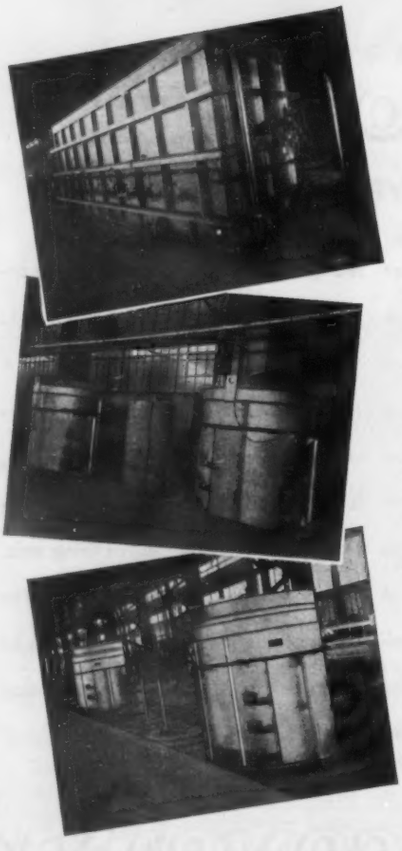

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Shipbuilding at Record Level

■ NAVAL expansion which a year ago would have been considered fantastic is under way in the United States. The program assures capacity operations in the country's shipyards not only for 1941 but for several years to follow. It will require in addition the greatest expansion of ways and yards in this country's history.

When in a single day last September, the President signed the two-ocean navy bill and the navy department immediately announced the award of 200 combatant ships, a protracted period of intense shipbuilding became a certainty. The navy already had 130 fighting ships building or on order, many of which had been contracted for only a few months earlier and which will be built concurrently with the latest ships authorized.

Combat ships now building or on order will require approximately 1,410,000 tons of steel, distributed over the next four to seven years.

When the present program is completed, the United States navy will include 728 combat ships, with an aggregate tonnage of 3,160,000. It will be equalled by no other nation's navy. A breakdown of the ships in service and building or on order follows:

Type	In Service	Building or On Order	Total
Battleships	15	17	32
Aircraft carriers	6	12	18
Cruisers	37	48	85
Destroyers	197	211	408
Submarines	103	82	185
Totals	358	370	728

The new battleships will be the largest of any country, being in the 45,000-ton or larger class. They are costing about $100,000,000 each. The aircraft carriers have 25,000 tons displacement and cost $57,000,000 each. Many of the cruisers will be of the heavy type.

More Yards Needed

Such a gigantic program obviously could not be executed in existing yards. Both the government and private yard owners started expansion programs when the need for the larger navy developed. These expansions are well distributed geographically, on the Atlantic, Gulf and Pacific coasts and to a lesser extent on inland waterways.

The government is scheduled to expend $150,000,000 on expanding ways and yards during 1941 and 1942. Another $100,000,000 has been authorized for the expansion of facilities for the manufacture of ordnance, munitions and armor plate.

In addition to the combatant ships, the navy is authorized to build or acquire 200,000 tons of auxiliary vessels and $50,000,000 worth of patrol craft. Some of these, such as the torpedo boats, will be built new; others will be trawlers, yachts and similar craft acquired from private owners and converted to navy needs.

Merchant shipbuilding also continued active through 1940 and no decrease is in sight. On Nov. 1, 302 vessels, aggregating 1,527,400 gross tons, were under construction, according to the American Bureau of Shipping, New York. This volume has been fairly well maintained since the sharp upsurge in shipbuilding started in September, 1939.

The continued strength of merchant shipbuilding has been in spite of the extension of the war zones in which American vessels are prohibited. Losses incurred by Great Britain and neutral countries have stimulated a demand for American bottoms as replacements. Furthermore, the navy department and other government agencies have been interested in building up the merchant marine strength that these ships might be available as auxiliaries in case of emergency.

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Design of new merchant ships has been affected by this possibility. Cargo ships and tankers have higher speeds. Some liners have been designed for possible conversion to aircraft carriers.

Welding made continued gains during 1940 and was applied to larger ships. Numerous C-3 type cargo vessels were of all-welded construction.

River barge and tow boat construction was stimulated by increased traffic and several large programs were underway at year's end. On the Great Lakes, no ore carriers have been built since 1937. Pittsburgh Steamship Co. has announced it will build two freighters during the coming year. Prospects for heavy ore movement and the loss of several units of the ore fleet may cause other companies to do likewise.

In addition to the large domestic shipbuilding program, Great Britain is likely to transfer a larger share of its construction program to this country. Sixty 10,000-ton freighters were placed here by Britain late in the year and will require 185,000 tons of steel, as well as the construction of 20 new ways at two new yards.

This, it is believed, is only the forerunner of a tremendous building program for British account. The toll taken by submarines, mines and aircraft attacks has threatened Britain's life line of sea commerce and bombing attacks hinder new construction on the island.

Meanwhile Great Britain has been augmenting her fleet by the purchase of over-age merchant ships, many of which were built during the World war. About 60 more of these vessels are reported to be still available. This country also traded 50 over-age destroyers to Britain for eight leases of sites for air and naval bases.

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Good Year for Can Industry

■ CONTAINER manufacturers experienced a favorable year in 1940, one of the best in history from the standpoint of sales. Prospects for the new year are equally bright.

Aiding the outlook for increased consumption of sanitary cans in 1941 is a prospective enlargement in crop acreage. The 1940 pack of leading canned vegetables totaled about 103,000,000 cases on the basis of No. 2 cans, compared with slightly less than 95,000,000 cases in 1939. Since carryover from the 1939 pack was nearly 11,500,000 cases—less than half that of the previous season—supplies for the 1940-41 distributing season total about 114,500,000 cases. This compares with the previous season's supply of 120,000,000 cases.

Tin Mill Operations

Net tons

	Annual capacity	Production	Per cent of capacity	Tin plate exports
1934	2,987,774	1,692,131	56.7	203,800
1935	2,829,407	1,856,908	65.6	148,077
1936	2,975,504	2,361,986	79.4	263,853
1937	3,317,216	2,758,294	83.2	396,860
1938	a1,827,791	675,745	37.0	†175,917
	b2,047,472	942,572	46.0	
1939	a1,710,643	645,311	37.7	†342,188
	b2,168,544	1,916,150	88.4	
1940*	a1,201,960	381,942	38.1	†389,891
	b2,930,860	1,906,883	78.1	

*Ten months; a—hot rolled; b—cold reduced; †both grades.

Increased consumption of canned foods is indicated for 1941 as a result of improved national income. Our growing army will be a large outlet for canned goods, although its requirements will not represent a net gain in food consumption.

Demand for tin and terne plate for can manufacture during 1941 is expected to represent a continuation of the trend prevailing in past years. Can requirements for packing of major foods, such as corn, peas, tomatoes, etc., have been sustained over the long term but have

been subject to year-to-year fluctuations resulting from variations in crops. Total consumption of cans for the packing of foods is gaining, however, due to introduction of new products and growing popularity of established goods. Typical of the latter are tomato and fruit juices, sales of which have multiplied rapidly the past ten years.

General line can production over an extended period also has shown steady gains, though influenced by general business conditions. While no new applications comparable in volume to such major outlets as beer or oil cans developed last year, numerous minor markets were created which in the aggregate resulted in sizable tin and terne plate requirements. Demand for beer cans in 1940 is believed to have reached an all-time peak of more than 750,000,000 units. Sale of lubricating oil in sealed containers, made largely of terne plate, has increased each year since its introduction about 1933. Antifreeze for automotive use also is being marketed in increasing volume in cans.

Tin plate output in 1940 ranked among the largest in history, being estimated at close to 2,700,000 net tons. The increase of less than 5 per cent over 1939 tonnage, however, was small compared with the expansion in output of all products, and, in addition, production was slightly below that of the record year, 1937.

Exports were a factor in swelling operations in 1940, particularly during the early part of the year. Foreign shipments through August more than exceeded exports of 305,525 tons for all of 1939, but a letdown in later months caused the 1940 total to be little changed from that of 1937.

Cold-Reduced Dominates

Cold-reduced tin plate continued to dominate the market last year, widening further its portion of total output. In the first ten months 83 per cent of all tin plate produced was cold-reduced plate, compared with 76 per cent in 1939 and 58 per cent in 1938.

Responsible for more than 55 per cent of 1940 consumption of tin, the container industry is highly concerned with the maintenance of imports of this metal, since the United States is wholly dependent on foreign supplies. To date, no difficulties have been met in obtaining sufficient tin, but in the event of scarcity several courses are open to the can manufacturer.

Recent improvement in the quality of base plate permits a reduction in amount of tin used in coating plate for food cans without seriously impairing their quality. A large saving in tin also could be effected by using black plate instead of tin plate for manufacture of containers for packing certain types of foods and nonedible products. Use of black plate for such an apparently minor application as bottle caps, for instance, would result in a substantial saving in tin.

Black plate coated with enamel has been found by tests to give adequate protection to quality of many canned foods, although protecting processes alone, such as phosphating or Bonderizing, have not proved entirely successful in guarding against chemical attack by certain foods. For certain applications glass, fiber or other material could be substituted for tin plate. Reclamation of tin from used cans could be stimulated if necessary, providing an annual recovery of 10,000 to 20,000 tons of pig tin.

Estimated tin imports for 1940 were 120,000 long tons, nearly 80 per cent of which was Straits, the grade most generally used in tin plate manufacturing. This is a larger percentage than usual. Moreover, receipts were not only about 80 per cent larger than in 1939 but imports in the first 11 months alone exceeded those of the best previous full year, 1929, when we re-

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of thinking waste disposal costs could not be reduced

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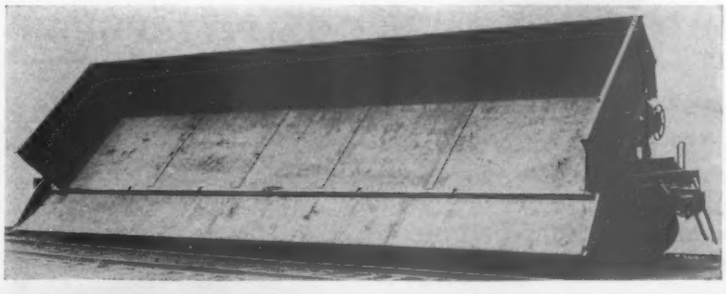

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ceived 89,502 tons. During the last quarter of 1940 this country was receiving more than 80 per cent of the world's tin shipments, including a like proportion of Straits metal, and those receipts were approximately twice the rate of consumption.

Actual consumption last year was about 85,000 long tons, thereby adding 35,000 tons to our invisible stocks. National defense officials estimate that we now have on hand somewhat more than a year's supply of tin. No detailed statement has been issued, but this is taken to mean that the tin owned by the government and private consumers is close to 85,000 tons. By July 1, 1941, the Metals Reserve Co., a federal organization operated by the Reconstruction Finance Corp., is supposed to have bought 75,000 tons of tin which is to be held as a reserve for at least three years. This is the largest single tin "pool" ever collected.

Tin prices were relatively stable last year, considering the disturbing influence of international conditions. Spot Straits had an extreme monthly average range for the year of 45.85c to 54.57c. Operations of the Metals Reserve Co. were instrumental in minimizing price fluctuations around the 50.00c level during the latter half.

Appliance Makers Active

■ MANUFACTURERS of household appliances, business machines, air conditioning equipment and similar light metalworking plants this year will undergo the most extensive transition in their history. While production of normal peacetime products will continue at a high rate, a large proportion of their capacity must be diverted to national defense materials.

Thus refrigerator manufacturers also will make airplane parts and cartridge cases. Vacuum cleaner makers may be asked to build gas mask parts. Business machine manufacturers will make automatic pistols, bomb fuses and artillery shell. Bicycle builders will turn out machine gun stands. Air conditioning plants may build bomb bodies. Washer and ironer companies will divert part of their plant to creating artillery ammunition components. Postal meter companies will produce bomb mechanisms. Printing equipment concerns will also make fire control equipment, artillery equipment and machine tools. Steel office furniture builders will be asked to produce bomb containers.

Military Demands Heavy

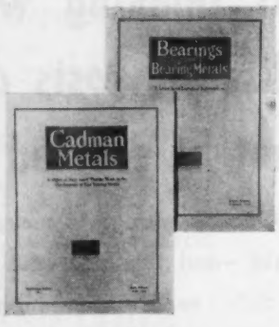
In addition to these strictly military materials, a tremendous amount of these companies' ordinary peace-time products, either as is or adapted to military needs, will be required by the military establishment. Only about one-tenth of the requirements of an armed force is specifically military; the rest are materials to feed, clothe, house and transport the personnel.

During the closing months of 1940, large orders were placed with light metalworking companies for the production of steel bunks, metal lockers, mess tables and chairs, steel folding cots, dish washing machines, peeling machines, bakery equipment, field ranges, steel shelving, refrigerators, heating stoves, food carts, overbed tables, cooking utensils and tableware, laundry equipment and scores of similar items.

While millions of dollars in orders for both combat materials and nonmilitary items already have been awarded, they have been placed largely with the major companies or those smaller companies equipped to produce such items with minimum changeover. As the defense program proceeds, a greater degree of conversion of facilities will be re-

Speaking of helpful literature

it will interest you to know that we have prepared two interesting bulletins concerning bearings and bearing metals. These booklets tell of the requirements of a bearing metal, the research work of the late A. W. Cadman; properties, tests and selection of the proper Babbitt metal, etc. In the event that you care to examine a little semi-technical data and look over a digest of 80 years' pioneer work in the development of fine bearing metals, we suggest that you clip the attached coupon and mail it to us. Your bulletins will be forwarded to you immediately. We believe you will find them helpful and instructive.



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quired. Smaller companies which are not equipped to produce entire units or defense materials may be awarded subcontracts for the production of parts.

Meanwhile, increased employment and payrolls will increase the demand for normal peace-time appliances to a level above 1940, which in some lines established records. Capacity operations for practically all light metalworking plants appears assured and some expansion will be necessary.

Sales of household refrigerators passed the previous record (2,203,335 in 1937) in the first eight months last year. Sales for the entire year are estimated to have exceeded 3,000,000. When it is considered the average refrigerator requires approximately 190 pounds of steel, exclusive of scrap, the size of this market becomes obvious. Within the industry, the price wars and other retail problems should be alleviated by narrowing of the gap between demand and productive capacity.

Electric Ranges Up 25 Per Cent

Electric range sales in 1940 were approximately 25 per cent ahead of 1939, indicating both the higher buying power of the past year and the trend toward all-electric kitchens. Washing machine sales continued to advance, and were about 10 per cent above 1939 sales. Electric ironers advanced about 18 per cent.

Mechanical stoker shipments during the first three quarters were about 45 per cent ahead of the preceding year. As in past years, nearly 90 per cent of these were in class 1, domestic dwellings. These units require between 100 and 150 pounds of iron and steel each.

An estimated 6000 miles of new pipe line was completed in 1940, breaking the record established in 1939, when 5000 miles was laid. National defense requirements have been and will continue to be a factor in this facility for the transportation of crude oil, gasoline and natural gas. Not only do pipe lines carry the fuel necessary for the navy, mechanized army ground units and a greatly expanded air force, but also the components for explosives.

Should the emergency become more intense, the facilities of the various operators may be interconnected to serve national defense needs more adequately.

■ Less than 2 per cent of the raw materials needed for manufacture of electrical equipment must be brought from abroad, according to a recent report by Andrew H. Phelps, general manager of purchases and traffic, Westinghouse Electric & Mfg. Co.

Report Welding Outlook Good

■ MANUFACTURERS of arc welding units as a rule have liquidated most of their usual stocks of finished apparatus and now are quoting future deliveries. The situation so far is not really tight since shipments of almost any type arc welder may be had in three weeks following receipt of order.

Volume of business steadily is increasing, however, so that further deferment of deliveries is expected. Roughly, 75 per cent of current demand for arc welders is for larger-scale peace-time production.

Most important demands for arc welders in connection with the armament program are from shipbuilders and from producers of artillery mounts and aircraft and aircraft parts. Heavy potential demand for arc welders is expected in connection with the construction of welded tanks and other mechanized units. A factor in the increased demand is the extensive use of arc welders in constructing new industrial buildings.

National defense work apparently

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SERVING THE STEEL INDUSTRY SINCE 1873

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EAST LIVERPOOL, OHIO

will be the leading factor in extending recent heavy demand for oxy-acetylene welding and cutting equipment into 1941.

This new armament industry has required the development of not only many new techniques and procedures in the welding art but also of oxy-acetylene welding rods. Emphasis on speeding defense work is seen likely to widen applications of flame cutting for various types of metal fabrication.

Outlook for the coming year in resistance welding equipment is unusually good because of favorable business prospects in the automobile, radio, refrigerator and aircraft industries, which account for 75 per cent of the KVA supplied by resistance welding machine builders. Approval of spot welding of stressed aircraft members by the army and navy, as well as by Great Britain, is believed to open tremendous possibilities for equipment in the aircraft industries.

One estimate is for a 400 per cent increase in aircraft welding, a figure which would imply a considerable power shortage since most aircraft plants are now at the limit of power supply. Solution may be the adoption of the "stored energy" type of welding, using condenser reactions. There are at least four such processes which now are available commercially.

Decision of the automobile industry to go ahead with 1942 model programs and the launching of a half-billion dollar aircraft parts program in the automotive parts industries are other developments reacting favorably on welding machine demand. While order books for some companies are full, others currently are in a slack season and are taking the opportunity to realign plants and personnel for increased activity.

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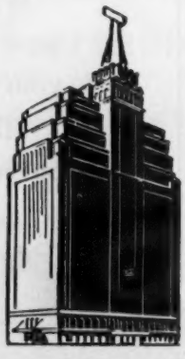

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Sheet Working Equipment

■ IN SHEET metal stamping and forming presses the situation as to deliveries varies. In some cases manufacturers still can ship out of stock, making delivery about two weeks after entering the order. In cases where the orders must be entered for production—particularly where an installation of a number of units is involved—it may take as long as four to six months to make shipment.

At present the volume of demand is about equal to the current rate of production. There are indications, however, demand will be increased as the armament program is intensified, as production of airplanes and tanks and some other units gains momentum and requires additional facilities.

Arms Program Spurs Demand

Future demand for other sheet metalworking equipment, such as slitters, roll forming machines, levelers, bending machines and the like, also depends to a considerable extent on development of the armament program, particularly aircraft. Current deliveries on such equipment range from eight to 12 weeks. Current demand is a little less active than it was a few months ago and now is about equal to current production.

Press brake deliveries now are four to seven months behind on an average and current demand is in excess of production. This is not only because of extensive peacetime requirements but because of the importance of this class of equipment in connection with the armament program. Press brakes are employed, among other things, for straightening armor plate, for forming parts of armored cars, trucks, airplanes, ships and gun carriages. They have many other applications in connection with the defense program, as in producing stainless steel kitchen equipment for the military forces.

New Records For Furnaces

■ INDUSTRIAL heat-treating furnace industry operated at an all-time high during the second half of 1940 and at a rate which was still increasing during the last quarter. Without any further gain in the rate, 1941 business should exceed the 1940 record. However, this depends mainly upon the extent to which users will accept builders' established designs and not insist upon changes and modifications unessential to successful operation.

This does not mean that the furnace industry is sacrificing its initiative and development work in favor of a standard furnace for every customer. Manufacturers merely want every customer to utilize available up-to-date designs, without unnecessary experimentation during the emergency. Manufacturers say they have designs which will meet practically all demands of the defense program, and utilization of these furnaces is urged to permit greater output.

Unlike in many other industries, production of industrial furnaces is not limited by factory capacity so much as it is by the limited number of engineers and draftsmen trained for the work. Every chango in design, even of relatively minor character, slows up output. The difference in delivery dates for available designs and for special or even changed designs is inducing many users to accept what manufacturers have to offer.

With similar co-operation from all users, spokesmen for the industry say it will meet all requirements of the defense program as long as constituent materials and devices are obtainable for their manufacture.

Cold Header Stocks Reduced

■ STOCKS of cold headers have been virtually wiped out, with the result that most current orders must be entered for production. In some cases where stock lots are being manufactured delivery is promised in six to eight weeks. In most cases deliveries range from three to six months while some of the larger machines cannot be shipped in less than nine or ten months.

Most cold headers now being bought are for production of ordinary bolts for automobiles and other peace-time goods. They also will be used in the production of many special parts. Demand for cold headers for manufacture of airplane bolts is increasing and is expected to increase on a much larger scale. Other phases of the defense program are tending to swell demand. As a result, intervals between placing of the order and the date of delivery are bound to lengthen in coming months.

Difficulties in obtaining satisfactory deliveries of materials and parts, a shortage of engineering personnel and of skilled labor all combine to handicap cold header manufacturers in moving production to the current high level of demand.

Handling Units Deliveries Slow

■ A TIGHT situation is reflected in deliveries of materials handling equipment. It varies in degree with the manufacturer and the product. Generally it results from the difficulty in replenishing inventories of materials and parts at materials handling equipment plants as rapidly as needed.

Today's situation may be described by explaining that when a new

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plant is laid down it will take at least one to two months after the orders have been placed to get deliveries of the units comprising the complete materials handling system. This is the case even when such plants are given the right-of-way because they tie in with the armament program.

Electric and gas-powered trucks, for example, might come in fairly soon whereas there might be a delay in the conveyors, the hand-lift trucks or portable elevators. Again, hoists and monorail systems might come to hand sooner than cranes and scales. In any event, at least one to two months is required to assemble a complete system.

The foregoing applies to standard units. When they have to be engineered especially for a given installation the usual deliveries now require an interval of three to five months. This is because of the scarcity of engineering personnel.

With present emphasis on production, and with materials handling equipment so important to production, the supply of such equipment is certain to become increasingly tight, with a lengthening interval between the time the order is placed and the date of shipment.

Forging Presses Booked Ahead

■ DEMAND for forging presses and hammers has been stimulated by the defense program and manufacturers are booked months ahead. Indications are that as new armament requirements develop orders will increase accordingly and delivery dates will advance far into the future.

In the horizontal forging machine and vertical forging press branch of the industry deliveries at present average about six months from date of orders. Some hammermakers have a backlog for eight months' operation night and day. Despite this they still are in position to deliver certain types of hammers in three to four months. On large types deliveries seldom are under one year. Backlogs have been gaining steadily and shipments are averaging about 80 per cent of incoming orders.

Deliveries on supplementary equipment, such as back rolls, coining presses, trimming presses, etc., are several months in arrears. Deliveries of drop hammers for use in the armament program average about eight months. Shipments are slightly in excess of new orders, but it is believed demand shortly will reverse this situation.

In the heavier forging equipment, such as steam hydraulic presses

and large open-frame hammers for the manufacture of large propeller shafts, gun barrels, etc., the shortage does not seem to be so acute.

Heavy Demand On Foundries

■ FOUNDRIES in all four branches of the industry are making rapid preparations to meet the tremendous demands for castings that must follow the accelerated pace of the national defense program.

While a small number of new plants have been built and many shop additions have been made, the greatest expansion in foundry capacity thus far has resulted from the modernization of existing plants through arrangement of production facilities and the installation of new equipment to replace obsolete machines or to extend mechanical operation. New plants, for the most part, have been built in fields where the demand for castings should continue active, even after the defense work has subsided, such as machine tools, aircraft, etc.

The foundry industry in the main is approaching capacity operations. Geographically, the greatest activity is to be found in the East and Far West, although the production of castings in the Central West is not far behind and is moving forward rapidly. While many foundries now are operating at full capacity on castings for armament and related purposes, the heaviest demands made on a majority of plants still originate from the ordinary commercial needs for immediate consumption in further manufacturing processes.

Operations at High Level

Early 1941 should see a marked trend toward defense work, the extent of the movement depending upon the willingness of numerous officials in Washington to recognize the immense possibilities provided the defense effort by modern steel, malleable, gray iron and nonferrous castings. The industry is attempting to apply foundry practices and products to the defense effort.

Steel foundries producing miscellaneous castings are operating between 80 and 85 per cent of capacity, and shops making railroad specialties are working at just a little lower rate. Steel foundries are booked up considerably beyond their capacity to produce, so that the high operating rate should continue for some time.

One of the striking developments in the application of castings to defense work pertains to the use of cast steel turrets and hulls for tanks. A number of steel foundries are producing cast armor plate for that purpose and undoubtedly the demand will continue to grow.

Malleable foundries are operating at near capacity, as determined by the available labor supply, material bottlenecks, etc., and most shops have heavy backlogs. While considerable indirect government work is being produced, the bulk of business in the malleable field is coming from ordinary requirements.

The gray iron industry is exceptionally busy with many companies operating at capacity. Direct contract with the government represents only a small portion of present demand in that industry, but large tonnages of gray iron castings are being employed as parts of machines and materials purchased for the army and navy.

Shortages of certain classifications of rolled steel used in the fabrication of various types of structures formerly produced as castings may result in the return of considerable business to the gray iron foundry. The nonferrous industry is operating at a high rate and those shops producing aluminum and magnesium castings for aircraft are unable to meet the present demands.

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Behind the Scenes with STEEL

Relax For Awhile

■ By the time you've struggled all the way back to here, you're probably tired of holding this three-pounder on your lap, so stretch out comfortably on the floor for a few minutes. We won't be too serious or keep you long.

A Real Job

■ This Yearbook, though, is certainly crammed full of some real dope and regardless of how busy you are, you owe it to yourself to take time out and go over it carefully. And particularly those contributions under the section, "Technical Progress Aids Defense." There's more meat in those pages than in the Chicago stockyards.

Army Mechanization

■ One bit of technical progress that will aid defense was missed entirely though. They tell us that mechanical minded geniuses have substituted a buzzer for the traditional bugler at one of the army camps. Just what they'll call the buzzer-presser has not yet been decided.

Tin Hats

■ Another thing that may have been overlooked is the wide difference in the shape and design of steel trench helmets. French, Italian, and even German helmets, it is said, stress beauty, but in general the prettier the helmet the less protection it affords and the more operations that are necessary (due to extra drawing operations, etc.). The British and American "bouncers," says one authority, provide the most positive protection, even if they don't stack up to what *Esquire* thinks the well-dressed young man should wear.

Beans De Luxe

■ Also on the list of defense aids is a new can, which the army may adopt, which will give the soldier a nice hot meal, wherever he happens to get hungry. It is a can within a can and when the outside shell is punctured a chemical reaction takes place between the contents of the outer shell and air. This permits the contents in the inner can to become piping hot. It sounds like a swell idea but just in case the outer shell should spring a leak, it may be a good idea to provide insulated knapsacks for soldiers carrying these portable kitchens.

Machine-Made Logs

■ Out in California another accomplishment has been chalked up to the lowly machine. This is a contraption that makes something from nothing, by taking the refuse redwood dust, and, with clever use of high pressure, binding agents, and automatic feed, turns the dust into valuable, hot-burning logs.

Vitamins For Industry

■ What salt tablets have become to shops where heat is part of the day's work, vitamin tablets promise to become in plants where sharp eyes, ability to match colors, and lack of "retinal fatigue" are factors. Inspectors at one of the G. E. plants were fed on vitamin diets, and rejects of enameled stove parts—due to imperfect color matching—dropped remarkably.

Picketing The Pickets

■ A good book could be written about the lore of picketing. There was, for example, a St. Louis industrialist who plastered signs all over his fence which pickets had to pass frequently (making it sort of a picket fence). They read: "This company is paying the pickets, and paying them double time. They've got a tough job on their hands." Then, there was the shrewd department store manager in New York City who provided fine chaise lounges, steaming hot coffee and doughnuts, with signs that read: "For Pickets Only," right out in front of the busy store. Latest counter-picketing tactics were employed by "Vic" Nelson, Glendale, Calif. building contractor, who featured well-dressed employes bearing shoulder signs that read: "The Union is Unfair to an Organized, Legitimate Builder."

SHRDLU.

tion of castings may reach the highest tonnage in history during the next 12 months.

Nonferrous Plants Expand

■ INDUSTRY faces 1941 with a shortage of some primary nonferrous metals but this situation is likely to be relieved before the year is well under way, despite growing needs in defense industries.

The situation in zinc was especially acute at the close of 1940 when producers' stocks dropped to well under 20,000 tons, all grades. Galvanizers still are finding it difficult to obtain supplies but allocation of available metal has averted much disruption of production.

Additional zinc production facilities now being placed in operation and under construction will increase the industry's effective capacity to 900,000 tons by the end of the second quarter, it is estimated. At the beginning of 1940, capacity was 814,000 tons, of which 600,000 tons was distilled zinc and 214,000 tons electrolytic.

Copper consumption also has been running ahead of production but plans are under way to bring in South American metal to supplement domestic supplies. The former will be used on defense contracts.

Lead production facilities appear to be ample and no large increase in facilities is contemplated by the industry. Tin is in an excellent position with present supplies on hand sufficient for more than a year.

Both Aluminum Co. of America, Pittsburgh, and Reynolds Metals Co., Richmond, Va., are increasing aluminum capacity. Output will be at rate of 690,000,000 pounds per year by July, 1941 and 825,000,000 pounds by July, 1942, compared with 465,000,000 in 1940. Aluminum Co. has placed order for first continuous mill for rolling aluminum.

Further expansion in production facilities is contemplated this year by the copper and brass fabricating industry, largely for defense work.

Some individual company programs largely involve rearrangement of present facilities. Chase Brass & Copper Co., Waterbury, Conn., as an example, will shift some of its equipment to effect straight-line production of defense materials.

American Brass Co., Waterbury, is expanding and improving facilities in all departments. Machine designs are being studied and changes made to increase capacity and improve quality. Similar im-

provements are being instituted by the Bridgeport Brass Co., Bridgeport, Conn., and the Scovill Mfg. Co., Waterbury. Phosphor Bronze Smelting Co., Philadelphia, maker of phosphor bronze and nickel silver products, will increase capacity about 25 per cent this year.

Revere Copper & Brass Inc., New York, will spend about $1,500,000 this year, about the same as in 1940. Now under construction at its Dallas division in Chicago is a $300,000 plant for producing 105-millimeter shells.

Business in a Changing World in 1941

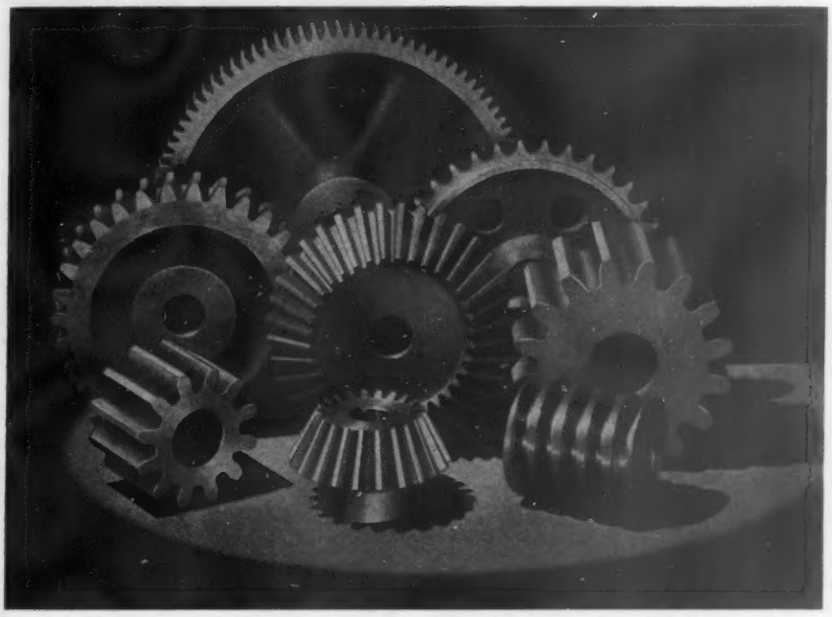
(*Continued from page* 195)

proposed revenue an increase of 3.1 per cent was imposed on the normal income tax of corporations earning more than $25,000 a year, with a graduated "excess profits" tax rising from 25 to 50 per cent over and above normal corporation income taxes.

Under the law, a corporation's profits are defined as "excess" if they exceed (a) $5000, plus 95 per cent of its annual average profits for the 4-year period 1936-1939, plus 8 per cent on new capital additions, or minus 6 per cent of net capital reductions; (b) $5000, plus 8 per cent on its "invested capital". Thus a corporation has a choice of either of these two methods of calculation.

A principal criticism is that the law discourages new undertakings and enlargements of existing properties, which require anticipation of special profits to compensate for the special risk involved. It is also argued that in the case of established companies, most of the excess profits earned during a period of defense procurement would probably not be distributed in dividends, but would be ploughed back into the business to provide a greater production than could be expected were the financing to be done by outside investors. These latter, it is said, might for several reasons hesitate to take the same chances as the management actually in, and therefore closer to, the business. Thus, it is contended, this type of taxation tends to curb the expansion of defense industries at a time when expansion is essential.

Two most desirable features, from the standpoint of business, were the amortization rulings and suspension of the profit limitations imposed by the Vinson-Trammell act on construction of naval vessels and aircraft. Under the Vinson act contractors had to agree to return to the treasury profits in excess of 8, 10 or 12 per cent, as regulations might happen to apply. The



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profit limiting provisions of the merchant marine act of 1936 also were suspended under certain conditions relating to subcontracting.

■ AN INTENSIVE drive for the unionization of all open shops and for higher wages is believed to be in prospect for the steel and metalworking industries during the current year. The drive for unionization will undoubtedly have the blessing of Washington, but how far labor will be permitted to go in its quest for higher wages without engendering the disapproval of the administration remains to be seen. No stronger inflationary element could be injected at this time than the undue skyrocketing of wages, and the administration, as well as business, apparently is keenly aware of it.

However, the scarcity of skilled help and the growing strength of organized labor make it appear probable that some increases in the defense industries will be witnessed before the year is over. Wage increases, in fact, are already being accelerated by the emergency, not only through advances in base rates in many individual cases, but because of the overtime features of the labor laws—the Walsh-Healey and wage-hour laws in particular.

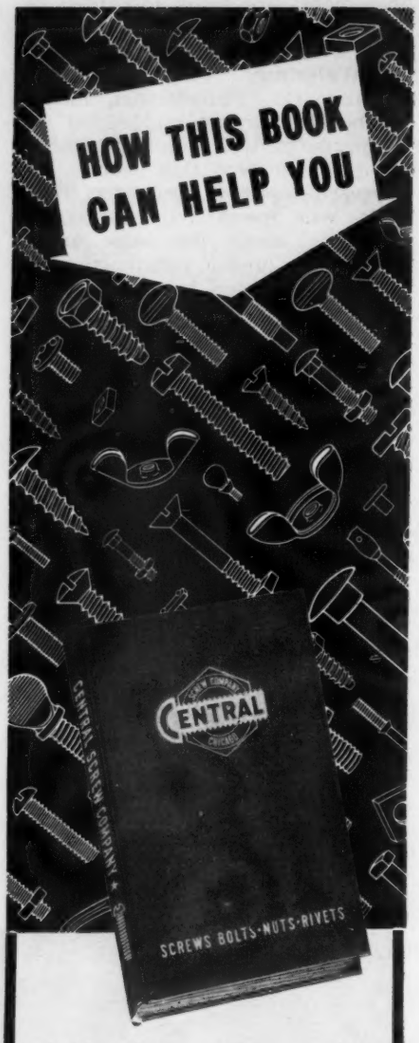
Overtime Pay Burden Heavy

Last October the weekly hour schedule under the latter regulation was reduced from 42 to 40 hours, thus affecting an estimated 2,000,000 workers in addition to the 12,000,000 or so, who already had become affected since the law began operating in 1938. Many of these are now drawing overtime pay not alone on the basis of the 30 cents per hour minimum of the wage-hour law, but on the basis of higher rates which already had been in effect at various plants. Regardless of how high the basic rate is, time and a half must be paid.

Under the Walsh-Healey act much higher base rates must be paid on work on all government contracts involving sums of $10,000 or more, and in these days of extensive rearmament this regulation is particularly potent. Inconsistency of the government imposing in the steel industry, where government work is concerned, a minimum that is more than 100 per cent higher than the rate now fixed by federal law on nongovernment work, already has been stressed.

In the steel industry in October wage earners averaged 39.4 hours per week, which is, of course, short of the 40-hour maximum, but coming so close, it goes without saying that many on the payrolls are receiving time and a half for overtime.

Significant is the fact that while



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the number of employes in the steel industry that month increased no more than 3000, payrolls gained more than eight and a half million dollars.

With respect to skilled labor, steel appears in much better shape than most other industries. It is one of the few defense industries where no shortage of labor, skilled or otherwise, is in early prospect.

This is attributed to four measures applied by the industry over a period of years: (1) Apprentice programs, which are now being conducted by the great majority of the steel companies and which have long been maintained by many of the larger producers; (2) job-training for specific duties, under which young men of ability are given intensive training for relatively brief periods in special work, with more than two-thirds of the companies now engaged in such training; (3) work-sharing during the depression periods, which retained thousands of skilled and semiskilled men on the payrolls instead of making it necessary for them to drift into other jobs; and (4) high wage scale, with wage earners in steel plants now averaging more than 85 cents, receiving about one-third more than the average wage in all manufacturing industries.

Shortage of skilled labor in most branches of industry was emphasized recently by Professor Sumner H. Slichter, Harvard university, who claims there are 650,000 fewer skilled workmen in American industry today than in 1930, allowing for a 50 per cent replacement of those who have either died or retired.

Working Hours Shortened

The situation is further complicated by the fact that working hours have been greatly shortened. In 1930, skilled workmen were working 48 hours at regular pay. Today they work 40 unless paid time and a half for overtime, but the premiums demanded for this extra work unquestionably account for a much shorter work week than ten years ago.

In any discussion of labor shortage government labor authorities point to the 7,000,000 to 8,000,000 unemployed, as a reservoir for the recruiting of defense labor. However, such reservoir includes relatively little skilled labor and while it does provide a potential supply for training and efforts are being made to develop training, this requires time and does not answer the problem of the moment.

Many economists and industrialists have urged present limitations on hours of work temporarily be suspended. Especially pertinent were the recent remarks of Defense Commissioner Knudsen, who said that

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the short working schedules make for an industrial "blackout" from Friday to Monday and are hampering defense work considerably. He urged a longer standard work week as an important step in overcoming the present lag in the rearmament program.

Such a suspension of existing working schedules would, instead of jeopardizing labor's gains, actually strengthen them.

Last year congress passed a bill suspending, during the period of emergency, the statutory maximum of eight hours daily and 40 hours weekly for persons engaged upon work contracted for by the maritime commission, to speed up the shipbuilding program. Similar action could be taken with salutary effect on work in defense plants generally. Recently, Canada has been considering the question of increasing the standard work week from 44 to 48 hours, through the voluntary action of employes.

As a preliminary step in the recruiting of skilled men, the government employment service, through its 1500 offices in various sections, has been analyzing and classifying the records of the unemployed men enrolled with the services. Interestingly, at the end of October less than 4,700,000 were registered, the lowest number since November, 1937.

Defense Commissioner Hillman has developed a plan, which includes the up-grading of semiskilled workmen through outside training, when plant training facilities are unavailable. Manufacturers have been co-operating actively with vocational training centers in the setting up of training courses and in the procuring of suitable equipment for training.

Some employers are subdividing work wherever possible, so that they may use semiskilled or unskilled labor; others are redesigning machine tools in an effort to break up operations which have required highly skilled mechanics.

With millions being spent on federal training projects there is always the possibility of some of these huge sums being diverted into social schemes under the guise of vocational training. Consequently, employers are having an added incentive for participation in the vocational training programs of their respective communities, to make sure that the money is being applied effectively.

Federal employment service plans to make a confidential monthly check of 20,000 employers, none of whom employs fewer than 20 workers, as to prospective labor needs over the following 60 days. Results of the surveys will be used not only to guide the federal service in recruiting workers, but to avoid dislocation of labor markets.

Labor Disputes Increasing

With wages having been advanced sharply over the past few years in the face of stable living costs, one incentive for wage increase demands present at the outbreak of the World war has been removed. However, labor disputes are on the increase, and while over recent months they have accounted for far less than the average of 2,368,000 man-days of employment lost monthly during 1937, they are assuming special importance where they directly effect defense work.

The Vultee Aircraft strike last November did much to arouse public indignation, and since then the government machinery for conciliating such disputes before they reach the stage where all work is stopped has come in for scrutiny.

Aside from the conciliation service division of the department of labor, the nearest approach to an official federal conciliation board, it appears, is the labor advisory committee, headed by Sidney Hillman and comprised of six representatives of the American Federation of Labor, six of Congress for Industrial Organizations, and

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four of the Brotherhood of Railway Trainmen, with not an employer representative in the group.

This board should be supplanted by a bipartisan nonpolitical organization similar to the old war labor board, which operated during the World war, with industry having equal representation.

Such an organization, with jurisdiction over industries vital to national defense, could administer concurrently the various labor problems now spread through a number of agencies, and thus bring greater measure of order and unity, as well as a more balanced viewpoint. If the board were to be set up without arbitrary power, men of high prestige and having the confidence of both industry and labor should be named.

The right to strike could be preserved, but the threat of strike could be minimized by requiring notice of intent to strike and then requiring a cooling period.

Enactment of legislation for defense similar to that of the railway labor disputes act also has been suggested. Under the railway act strikes on railroads must at least be delayed until the mediating boards have had an opportunity to determine the questions at issue and bring about a settlement.

A remedial program proposed by the labor advisory committee calls for the establishment of divisional offices in 25 industrial cities not only to recruit skilled labor, but to iron out labor disputes. Work of these offices would be supplemented by committees comprising four employer and four labor representatives, as well as representatives of government departments which purchase products of the industry involved. These branches and supplementary committees would seek adjustment of a dispute, should other conciliatory efforts fail, and would publish findings to bring the force of public opinion to bear, should their mediation likewise fail.

Estimating Draft Prospects

Army officials claim the induction of men under the selective service act will make relatively light drains on the average industrial company. They suggest that if the employer lists all male employes aged 21 to 36 and then deletes the married men and men with dependents and about 20 per cent more for physical defects (mainly heart, eyes and teeth), he will have a good approximation of those in his organization really eligible for military training.

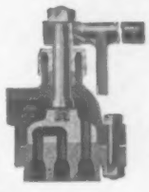
No industry will be able to claim deferment under the selective service system, although possibly 80 per cent of the employes in the aircraft industry, it is estimated, will be given such a stay. Generally only key men will be deferred for occupational reasons, and this does not necessarily apply to those in industries engaged in defense work. For instance, key men engaged in purely commercial work would not be called for military training if it appears that the employment of a number of others depends upon his remaining on his job.

Even should an employer fail to ask for deferment of a key man, the army has state advisors who will appeal in cases where they believe a man should remain at work.

Potential consequences of military absence upon the future employment of trainees is recognized by the act for it stipulates that a selected man is to be restored to his previous position, or one of like seniority, status and pay unless the employer's circumstances have so changed as to make it impossible or unreasonable to do so.

■ DR. HARRY A. MILLIS, professor of economics, University of Chicago, and generally esteemed by both industry and labor, was sworn in as chairman of the national labor relations board late in November. He succeeds J. Warren Madden, whose policies had long been under fire and whose term expired Aug. 27.

It is axiomatic that an open hearth furnace functions no better than its valves; that's why it will pay you to investigate . . . . . .



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Simultaneously, resignations of Nathan Witt, secretary of the board, and of two subordinates, became effective. Thus the groundwork was laid for changes in personnel and procedure.

However, agitation for fundamental changes in the law itself continues. Since the Wagner act was declared constitutional by the Supreme Court more than three years ago there has been a growing demand for its revision.

A congressional investigation of the act and its administration led eventually to the formulation of the Smith amendments to the Wagner act and last June they passed the house of representatives by the overwhelming vote of 258 to 129, in the face of strong administration opposition. The bill then went to the senate committee on education and labor where it languished.

Some observers believe the whole matter will be sidestepped for the duration of the emergency as a sop to labor in a period of crisis; others believe that should this law, which has already caused more labor disturbance than any other piece of legislation in history, continue to foment strife and misunderstanding, present opposition in congress will find support for its early modification, with the Smith amendments, now only an impotent record, serving as a springboard for future action.

Some of the 18 amendments did not receive the full support of industry; others did and made the bill as a whole much to be desired by those opposed to the act.

The administration and others in favor of the present act are now disposed to argue time should be allowed for Dr. Millis, as an authority of labor arbitration, to make a study before any further effort is made to amend it. They also contend the new board can now make new rulings and, if necessary, revise old ones, all of which is accepted by those favoring amendments as an open admission that the law is so ambiguous as to make rewriting necessary.

During the past year perhaps no one development in the connection with the NLRB (and for once the board was somewhat in the position of an innocent by-stander) created more of a furor than the "informal ruling" last October of Attorney General Jackson that defense contracts were not to be awarded to companies who had not complied with NLRB rulings. The attorney general's decision was freely interpreted as ruling out the placing of contracts, even where prospective recipients had appeals pending in the courts.

Ruling "Misinterpreted"

Later before a house committee, Mr. Jackson said that his ruling had been misinterpreted, that he had not meant to imply that defense contracts should be withdrawn or withheld from companies ruled merely by the labor board as violators of the Wagner act.

Officials of the defense advisory commission and the army and navy told the committee speed and efficiency were the primary considerations in the award of defense work, that labor board decisions were secondary.

As in the case of the Wagner act, efforts to amend or at least to suspend the operation of the fair labor standards act of 1938, more commonly known as the wage-hour law, met with failure, due chiefly to opposition of the administration. This opposition was based on "the necessity of preserving social gains", although the law was passed primarily with the hope of creating jobs, rather than protecting employes from overwork. As a matter of fact, state legislation forbidding hours that threaten health or welfare long has been in effect in most states. Under the federal law, it is pointed out, employes could be

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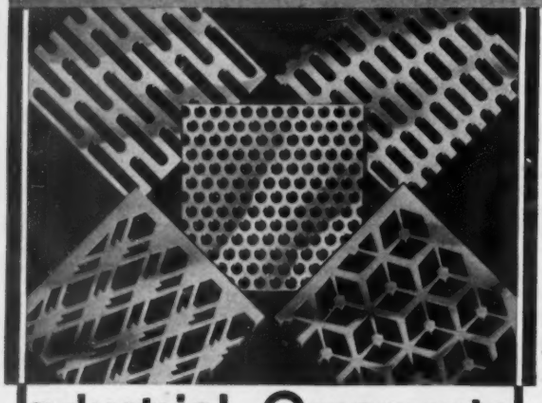

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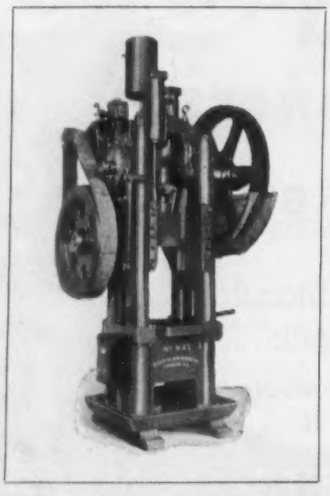

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The five-year-old social security act, which in 1939 underwent broad changes, as a result of nearly 200 amendments, is scheduled to come up for further attention this year. Senator Wagner, New York, announces that he will reintroduce amendments to broaden the scope of coverage of the law to include approximately 10,000,000 additional persons under the old age and survivors' insurance program and about 5,000,000 more under the unemployment insurance plan.

Coverage in the first group would include some 4,000,000 agricultural workers, 2,500,000 domestic servants, 750,000 employes of nonprofit institutions (excluding ordained ministers and members of religious orders) and 1,500,000 employes of states, counties and municipalities not now covered by insurance plans. The 5,000,000 persons under the unemployment insurance plan would include those in establishments having fewer than eight employes.

Wholesale revisions two years ago have done much to enhance the law in public opinion and extension of its coverage to groups meriting benefits is regarded by many as not only being fair but in general desirable in view of the change in social economy that has occurred in recent years. However, much of the ultimate success of the whole social security plan, it is believed, will depend upon the fiscal policies of the government and its ability to keep the dollar stable, for it is in terms of dollars, and not cost of living, that benefits are paid.

New Deal Trend in Courts

The trend of court rulings continues generally in support of New Deal policies, thus further tightening in many instances the controls of government bureaus and agencies over business and industry. This trend is not surprising to many observers, who point out that during the past eight years the President has had the opportunity of naming five of the nine Supreme Court justices, 79 of the 161 district federal judges and 36 of the 56 judges of the circuit court of appeals.

Many of these appointments have involved men of fine judicial temperament and legal background, but all too often it is contended, they have rested primarily on the prospective appointee's known acceptance of New Deal political and social philosophy. With the New Deal administration elected to carry on for another four years, further such appointments are only to be expected, and hence a continuation of the present trend in court rulings is predicted.

However, from time to time a decision is handed down which places a curb on bureaucratic assumption of power. In the steel industry, the most notable case was the Supreme Court decision in the Republic Steel case last November. This decision overruled NLRB in declaring that the company did not have to reimburse governmental relief agencies for wages paid employes held to have been deprived of their regular work.

Asserting that the intent of the Wagner act was essentially remedial in character, and not penal, the court observed that: "We do not think that congress intended to vest in the board a virtually unlimited discretion to devise punitive measures, and thus to prescribe penalties or fines which the board may think would effectuate the policies of the act."

It was a decision of particular timeliness, in the opinion of some observers, who regarded it also as containing the answer to issues raised a short time before concerning defense contracts placed with companies found guilty by the labor board of violating the Wagner act. It ruled out, they believed, all possibility of the government with-

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holding these contracts from companies found guilty.

Earlier in the year, in April, seven of the smaller eastern steel companies lost a Supreme Court decision of wide interest, which upheld the discretionary powers of the secretary of labor to determine limits of "locality" for the establishment of minimum wages under the Walsh-Healey act. Even the defining of 13 states as one locality was approved and the ruling that a minimum of 62½ cents an hour be paid in the principal steel producing sections was made effective.

1940 Sets New Record In Nickel Consumption

■ Consumption of nickel in all forms during 1940 showed an increase over that of 1939, which was the largest for any year in the life of the industry, according to International Nickel Co., New York. Diversification in uses of nickel and its alloys continued to increase.

Through extensive use in steel, cast iron and nonferrous alloys, nickel plays an important part in production of war equipment. With production increased throughout industry, the trend to wider uses of alloy steels continues. Markets for nickel-copper alloy steels are expanding, particularly in transportation and petroleum fields, due to fatigue and corrosion resistance. Increased interest is shown in SAE standard type steels, 3½ to 5 per cent nickel.

Activity in aircraft industries is causing increased use of high-strength, low-alloy, heat-treated steels for structural and engine parts. Automotive and aviation production are adopting nickel-chromium - molybdenum steels for stressed parts machined after heat treating to over 400 Brinell.

Use of nickel by iron foundries is increasing. Alloy cast irons of improved structure and properties are being widely specified, especially in the machine tool industry, including machine tool components and dies for stamping airplane parts.

Final figures for consumption of stainless chromium-nickel steels are expected to exceed appreciably those of 1939, due to successful service records for the material, coupled with expansion of production facilities and extension of information on fabrication methods.

Stainless Decorations For New Air Terminal

■ Colored stainless steel decorations, 5000 square feet in area and symbolizing America's progress in aviation, feature the new airlines terminal recently completed at Park avenue and Forty-second street, New York. To be dedicated to the aviation industry, Jan. 8, by the Mutual Life Insurance Co. of New York, its sponsors and constructors, the new $1,000,000 terminal took three years to plan and build.

Giant 30-foot stainless steel mural crowns the six-story building's entrance. Design is a decorative map of the world, continents in silver and oceans in black, with continental outlines emphasized in reddish-orange. Important airline stopping points, as mid-ocean islands, are in gold. Colors were impregnated in the steel by a patented process developed by Oscar Bach. Walls of the main waiting room are also stainless, with stylized metallic figures symbolic of America's achievements in the air.

Stock product of Allegheny Ludlum Steel Corp., Brackenridge, Pa., was utilized for the walls, each piece being two feet by eight inches on board one-quarter inch thick. Entirely welded, the terminal's structural steel was installed by Bethlehem Engineering Corp.

Five air routes will operate the terminal jointly: American Airlines, Eastern Airlines, Pan Ameri-

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"Longer Work Week Is Essential"—Sloan

■ Aggressive prosecution of the defense program and intelligent planning of what is to come after are the two objectives to be kept in mind in 1941, according to Alfred P. Sloan Jr., chairman, General Motors Corp., Detroit. Past the defense program's initial contract-awarding stage, industry in United States is getting organized to do the allotted jobs in an expanding way by developing essential machinery and specific tools, said Mr. Sloan.

"It must be remembered," he declared, "that industry deals with the realities—men, material and machinery. The time factor, in many vital particulars, is definitely fixed. As defense plants reach the stage of production, the multiple shift procedure, regularly employed in the automotive industry, should be adopted. And at least a six-day, even a seven-day, operation in the critical cases is essential. Labor should co-operate by waiving the premium for overtime for the period of the emergency. It is inflationary in character and tends to overstimulate the consumer goods industries."

Mr. Sloan said he believed the trend of production for industry as a whole in 1941 can be expected to reach higher levels, and probably establish a new record. He warned, however, that the prosperity will be purely artificial, as production for defense adds nothing to a nation's standard of living, is non-reproductive wealth.

Record Freight Tonnage Moved on Great Lakes

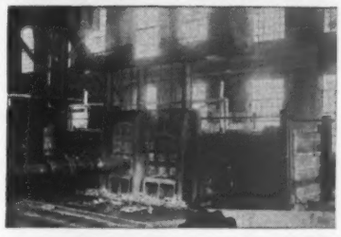
■ New high records for transportation of bulk freight on the Great Lakes during the 1940 season is announced by the Lake Carriers association, Cleveland. The figures include Canadian and American cargoes and for five commodities listed aggregate 142,866,876 net tons. This total is broken down as follows: Iron ore, 71,358,540 tons; bituminous coal, 46,540,000 tons; anthracite coal, 430,070 tons; grain, 9,644,950 tons; limestone, 14,893,316 tons.

Selling Costs are Four Times Advertising

■ As late as last summer American industry was using only 80 per cent of plant capacity; administration and overhead expenses average twice as much as selling cost; selling efforts are four times as expensive as advertising of most firms, according to a survey by the National Industrial Advertisers association, Chicago. This last annual study is based on reports from 345 industrial concerns of all sizes and types. It is the tenth survey of the association which has chapters in 20 industrial centers of the United States and Canada.

In the published study there are tables showing the percentage of the sales dollar spent for materials, labor, manufacturing costs, and other items (including profits); the percentage spent for selling and for advertising, broken down by product classifications and also by the size of the company; figures on the number of companies selling direct and through distributors; comparisons between budgets for 1939 and 1940; administrative information; how educational material is charged; and detailed break-downs of advertising budgets, showing the amounts spent in different media, such as magazines, radio, direct mail, exhibits, catalogs, etc.

The report has been distributed to members from the association's headquarters at 100 East Ohio street, Chicago.



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Galvanizing Industry Gains in Output, Workers

■ Establishments doing galvanizing and other coating reported slight increases in employment and production, and a slight decrease in wages for 1939 as compared with 1937, according to preliminary figures compiled from returns of the census of manufactures for 1939.

The 1939 census of manufactures is the first census for which employes who were primarily engaged in distribution, construction and similar activities have been called for separately on the schedule. It is not known how many of the wage earners reported for 1937 were engaged in distribution and construction and how many were engaged in manufacturing. Employes of the plants reported as engaged in distribution and construction activities in 1939 are not included in this preliminary report but will be included in the final report.

Wage earners primarily engaged in manufacturing products employed in this industry in 1939 numbered 1212, an increase of 8.3 per cent compared with 1119 reported for 1937, and their wages, $1,342,647, were below the 1937 figure, $1,376,140, by 2.4 per cent. Value of products of the industry for 1939 amounted to $6,195,640, an increase of 3.4 per cent compared with $5,994,070 reported for 1937.

German Machinery Production High

■ High production of machinery continues in Germany, particularly in the machine tool industry and in the factories supplying equipment for the construction, electrical, woodworking, synthetic rubber and textile industries, according to a report from the American commercial attache, Berlin. Among the noteworthy wartime developments have been the reduction in the use of cast iron and steel parts, the extensive use of electric welding, the progressive standardization of many lines, and the sharp trend toward fully automatic types of machinery.

Regimentation and co-ordination of the industry have been further extended; rationing of metal supplies has continued; exports to most overseas countries have been eliminated, but they have increased to southeastern Europe, Scandinavia and Russia. The shortage of skilled workers has become even more acute than before the war, although efforts have been made to alleviate this situation by bringing workers from Bohemia and Moravia and by utilizing the machinery industries in occupied countries.

The machinery industry has been organized on a corporate basis, similar to the organization of the industry in Italy, making use of both horizontal and vertical cartels within the industry. The strict application of the principle of leadership, the elimination of wasteful competition, planning for many years ahead, and especially the pooling of research efforts have resulted in a far-reaching co-ordination of the industry.

This system is claimed to have reached a high degree of perfection since the appointment of the Trustees for Machinery Production in December, 1938.

5900 Back Up Salesmen

■ Backing up the steel industry's 3100 full-time salesmen who serve the industry's thousands of customers, are 5900 members of the sales departments whose work does not include sales calls on customers, according to a survey recently made by the American Iron and Steel institute.

That total includes sales executives, branch office managers, clerks and office workers, and the large force of experienced engineers and metallurgists assigned to sales departments to work with the customers of the steel companies.

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Construction and Enterprise

Illinois

AURORA, ILL.—Austin-Western Road Machinery Co., Aurora, Ill., has awarded contract for construction of one-story, 70 x 300-foot addition, to be used for manufacture of portable rock crushing plants.

BELLWOOD, ILL.—W. M. Hart Co. has let contract to E. L. Lonergan Co., 203 North Wabash avenue, Chicago, for one-story 350 x 450-foot factory. (Noted Dec. 23).

CARTHAGE, ILL. — Western Illinois electric co-operative, L. C. Marvel, project superintendent, has awarded contract for construction of 132 miles of rural electric lines to Stotts Electric Co. Inc., Altamont, Ill. Stanley Engineering Co., Muscatine, Iowa, consulting engineer.

CHICAGO—Standard Stamping & Perforating Co., 3131 West Forty-ninth place, has begun construction of one-story, 85 x 202-foot addition to cost about $30,000.

CHICAGO—Ford Motor Co., 12600 Torrance avenue, is constructing a power plant addition at estimated cost of $140,000.

CHICAGO—Ingersoll Steel & Disc division, Borg-Warner Corp., 1030 West 120th street, is building a one-story addition to provide 50,000 square feet of space at cost of about $75,000.

CHICAGO — Owens-Illinois Can Co., 6501 West Sixty-fifth street, is considering erection of three-story, 160 x 360-foot warehouse addition, affording 172,000 square feet of space and more than doubling present facilities. Cost is expected to be upwards of $300,000.

CHICAGO—Carbide Tool Co., 356 West Huron street, Chicago, has begun erection of one-story factory at 4401 Rice street, at cost of about $35,000. New equipment is being purchased, including lathes, milling machines and grinders.

CHICAGO—Rheem Mfg. Co., 3425 South Kedzie avenue, is considering enlarging facilities with construction of additional plant building. The company recently announced a $300,000 expenditure for expansion to its Sparrows Point, Md., plant. (Noted Dec. 23)

CHICAGO—Roth Mfg. Co., 1600 South Kilbourn avenue, maker of railway passenger car heating and air conditioning equipment and boilers for train generators, has started construction of factory addition to cost $15,000. The new building will add about 8700 square feet to the company's present facilities.

CHICAGO—Lindberg Engineering Co., 221 North Laflin street, has plans to build a new plant to cost approximately $250,000. A site has been purchased at Campbell avenue and Hubbard street on which will be erected a new factory and a three-story office building. (Noted Nov. 11).

CHICAGO—Continental Can Co. has purchased a tract of land 138 x 310 feet adjacent to its plant at 5401 West Sixty-fifth street. This, with another tract to be bought soon and one acquired recently, will provide a site 138 x 1000 feet. The parcel still to be purchased has a building containing 33,000 square feet which will be used in manufacture of steel containers. This move is part of a $15,000,000 expansion program announced last September and to affect six of the seven main Chicago plants.

CICERO, ILL.—Danly Machine Specialties Inc., 2130 South Fifty-second avenue, Cicero, is erecting a one-story, 350 x 640-foot machine shop addition to its plant. New machinery will be purchased.

ELGIN, ILL.—McGraw Electric Co. is erecting additions to its factory and warehouse here. Cost will exceed $40,000 with equipment.

HARVEY, ILL.—Ingalls-Shepard division, Wyman-Gordon Co., maker of drop forgings, has started work on a $150,000 plant expansion program, including a one-story forge shop, an office building and other smaller units. Considerable new equipment will be purchased, including 50-ton steam drop hammers and 20-ton steel yard cranes.

NORTH CHICAGO, ILL. — Fansteel Metallurgical Corp. has about completed a $150,000, one-story steel addition, 48 x 200 feet, to be used exclusively for production of tungsten metal. Equipment is now being installed and the plant is expected to be in operation Feb. 1.

PETERSBURG, ILL.—Menard electric co-operative, A. E. Becker, project superintendent, has let contract for construction of 226 miles of rural electric lines to White City Electric Co., Chicago. Stanley Engineering Co., Muscatine, Iowa, consulting engineer.

ROCKFORD, ILL. — Woodward Governor Co., 216-218 Mill street, will take bids soon on construction of factory building to cost $100,000. Harza Engineering Co., 1208 West Wacker drive, Chicago, is in charge of plans.

Connecticut

MILFORD, CONN.—Milford Rivet & Machine Co., Post road, has asked bids for erection of one-story factory addition costing $40,000. L. F. Caproni, 1221

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Chapel street, New Haven, Conn., engineer.

NEW BRITAIN, CONN.—Corbin Screw Corp., division of American Hardware Corp., High street, has let contract to Carlson & Torrel, Dwight street, for two-story 62 x 95-foot steel plant addition.

NEW HAVEN, CONN.—United Illuminating Co., 80 Temple street, has let contract for power plant to Dwight Building Co. and C. W. Blakeslee & Sons Co., to cost over $40,000. Westcott & Mapes Inc., 139 Orange street, engineer.

Massachusetts

GREENFIELD, MASS.—Greenfield Tap & Die Corp., Sanderson street, will soon let contract for two-story, 82 x 214-foot plant addition. McClintock & Craig, 458 Bridge street, Springfield, Mass., engineers.

SPRINGFIELD, MASS. — Production Tool & Die Co. Inc., 562 St. James avenue, will erect a machine shop to cost over $40,000, including equipment.

New York

FARMINGDALE, N. Y.—Republic Aviation Corp., Conklin street, will soon let contract for one-story manufacturing building. Albert Kahn Inc., 345 New Center building, Detroit, engineer.

JAMESTOWN, N. Y. — Crescent Tool Co., M. Peterson, in charge, is considering plant addition. Cost over $40,000.

JAMESTOWN, N. Y. — Weber-Knapp Co., 441 Chandler street, will build plant addition costing over $40,000.

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JAMESTOWN, N. Y.—Rane Tool Co., H. J. Randall, president, will build one-story plant addition. Cost $40,000 with equipment.

NEW YORK—Consolidated Edison Co., 4 Irving place, plans plant improvements, including installation of new turbine and boiler, and altering and erecting new additions.

New Jersey

DOVER, N. J.—McKernan Terry Corp., 100 Richards avenue, will build one-story, 60 x 140-foot steel factory, contract for design and construction of which has been awarded to Austin Co., 19 Rector street, New York. Cost about $40,000.

NORTH PLAINFIELD, N. J.—Fischer Casting Co. will erect one and two-story steel frame foundry building. Cost $60,000.

Ohio

CLEVELAND — Lake Erie Steel & Blanking Co., 221 East 131st street, has plans for two-story, 49 x 126-foot factory addition, costing $40,000. E. G. Hoeffer, 5005 Euclid avenue, engineer.

CLEVELAND—Ferro Enamel Corp. will soon begin construction of $100,000 addition to its plant at 4150 East Fifty-sixth street.

CLEVELAND—Murray Ohio Co., 115 East 152nd street, has awarded contract to Hadlock & Krill Co., 2169 East Thirty-third street, for erection of one-story, 75 x 120-foot and 30 x 100-foot factory additions. Cost estimated at $40,000.

CLEVELAND—Cleveland Wire Cloth & Mfg. Co., 3673 East Seventy-eighth street, will increase manufacturing space with two-story, 68 x 94-foot addition. Total cost about $30,000. A. L. Crone is president.

CLEVELAND—Otis Steel Co. will spend $750,000 for improvement and expansion program at its Riverside plant. Program provides for increasing annealing facilities for sheet and cold-rolled strip mills, improvement in coke works and installation of new turbo blowers and high pressure boilers at blast furnaces.

DAYTON, O.—Lear Avia Inc., W. P. Lear, president, Vandalia, O., will build new plant here for manufacture of airplane navigation instruments. Cost estimated at $300,000.

DOVER, O.—Knapp-Monarch Co., 3501 Bent avenue, St. Louis, is considering establishment of plant here.

ELYRIA, O.—Duplex Mfg. & Foundry Co., 280 West Bridge street, is starting work on foundry building to cost $6000.

FOSTORIA, O.—Seneca Wire & Mfg. Co. will build a $10,000 addition to its factory.

WARREN, O.—American Welding & Mfg. Co. has let contract to W. B. Gibbons Co., Warren, for erection of one-story, 58 x 216-foot steel factory, to cost about $50,000.

Pennsylvania

ERIE, PA.—Berry Tool & Machine Co., J. Cavill, president, 329 West Twelfth street, has awarded contract to Martin Schenker & Son, 3901 Fruit street, to build one-story, 50 x 120-foot factory.

JENKINTOWN, PA.—Standard Pressed Steel Co., Stewart avenue, will erect 75 x 120-foot and 75 x 145-foot plant buildings, contract for which has been let to Townsend, Schroeder & Wood Inc., 1700 Sansom street, Philadelphia. Cost estimated at $60,000. Widdicombe Engineering Co., Sansom street, Philadelphia, engineer.

PHILADELPHIA — Philadelphia Steel Abrasive Co., Lewis and Ashland streets, will build factory at cost of about $40,000.

PHILADELPHIA—Molded Insulation

Co., East Price street, has let contract for three-story, 52 x 175-foot factory to J. A. Robbins, 10 South Eighteenth street. Estimated cost $100,000. (Noted Dec. 30).

PHILADELPHIA—Edward G. Budd Mfg. Co., Twenty-fifth street and Hunting Park avenue, has let contract to Wark & Co., 1700 Sansom street, for manufacturing plant. Estimated cost over $500,000. Ballinger Co., 105 South Twelfth street, engineer.

Michigan

ANN ARBOR, MICH.—Buhr Machine Tool Co., Ann Arbor, has awarded contract for a machine and pattern shop to Clausen Co., Detroit. Fry and Kasurin, Ann Arbor, architects. (Noted Nov. 18)

COLDWATER, MICH. — Shoecraft, Drury and McNamee, Ann Arbor, Mich., consulting engineers, are preparing preliminary survey for proposed improvements to water and sewage systems for village of Coldwater.

DETROIT—Bower Roller Bearing Co., 3040 Hart, has let contract to Austin Co., 429 Curtis building, Detroit, for erection of $60,000 factory addition.

DETROIT—Pellow Machine Co., 6527 Epworth street, has let contract to Ivan C. Shier, 400 West Warren, for erection of $18,000 factory building.

DETROIT—Square Tool & Die Mfg. Co., 3327 East Vernor, will erect a factory building on Hoover road near Eight Mile road. Walter A. Bernardi, Detroit, architect.

DETROIT—Packard Motor Car Co., 1580 East Grand boulevard, has awarded general contract to O. W. Burke Co., Detroit, for one-story factory building. Albert Kahn Inc., 345 New Center building, architects and engineers.

HOWELL, MICH.—Howell Electric Motors Co., Howell, has awarded contract to H. G. Christman-Lansing Co., Lansing, Mich., for erection of addition to plant. (Noted Dec. 16)

KALAMAZOO, MICH. — Shakespeare Products Co., Kalamazoo, has awarded contract to M. C. J. Billingham, Kalamazoo architect and contractor, for additions and alterations to its factory building.

MUSKEGON, MICH.—Work has been started on a $30,000 addition to plant of Muskegon Motor Specialties Co., Muskegon. Peter Ramberg, Muskegon, has the contract.

NEWBERRY, MICH.—Village, Sidney D. Foster, president, is planning construction of sewage treatment plant.

WEST BRANCH, MICH.—City council has authorized purchase of site southeast of city for erection of sewage disposal plant.

District of Columbia

WASHINGTON—Bureau of supplies and accounts, navy department, will take bids to Jan. 10, schedule 4709, one motor-driven surface grinder; schedule 4716, six motor-driven medium heavy duty engine lathes, without motors, delivered Sewall's Point, Va., and Mare Island, Calif.; schedule 4729, six universal milling machines, delivered Sewall's Point, Va., and Mare Island, Calif.; schedule 4730, geared head precision engine lathes, delivered Washington; to Jan. 16, schedule 4678, self tapping sheet metal screws, delivered Sewall's Point, Va., and San Diego, Calif.

Missouri

MARYVILLE, MO. — Nodaway-Worth electric co-operative, Earl W. Williams, superintendent, has awarded contract to Jensen Construction Co., Des Moines, Iowa, at $275,970 for construction of 412 miles of transmission lines. Paulette & Wilson, 1006 Kansas avenue, Topeka, Kans., consulting engineers.

ST. LOUIS—Midwest Piping & Supply Co., 1450 South Second street, has let contract to Fruin-Colnon Contracting Co., 502 Merchants-Laclede building, for erection of one-story, 101 x 140-foot factory addition. Cost with equipment, $40,000.

ST. LOUIS—Carter Carburetor Co., 2826 North Spring avenue, has awarded contract to L. O. Stocker Co., Arcade building, for erection of one-story, 150 x 179-foot steel addition to its factory at 2840 Spring avenue. Estimated cost, $150,000. The same contractor is also building a one-story, 25 x 40-foot boiler house for the Carter company at 3637 St. Louis avenue, cost of which is estimated at $15,000, without equipment.

STOCKTON, MO.—Sac-Osage electric co-operative, Henry C. Cowan, president, is taking bids to Jan. 14 on construction of 146 miles of transmission lines. Frank Horton & Co., Lamar, Mo., consulting engineer.

Arkansas

MALVERN, ARK. — Magnet Cove Barium Corp., L. Harrison, general manager, plans expansion of plant facilities; will install new equipment.

Oklahoma

COLLINSVILLE, OKLA.—REA has allotted $99,000 to Verdigris valley electric co-operative, Lawrence H. Lange, manager, to finance construction of 124 miles of rural transmission lines.

SEMINOLE, OKLA.—REA has allotted $218,000 to Canadian valley electric co-operative, O. Jameston, president, to

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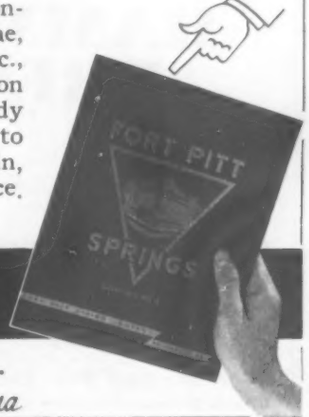

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Minnesota

McINTOSH, MINN.—Village, George F. Ketman, clerk, is taking bids to Jan. 10 on furnishing equipment for sewage treatment plant. Specifications obtainable from A. A. Hawkinson, Detroit Lakes, Minn., consulting engineer.

Texas

HOUSTON, TEX.—American Can Co., Lockwood and Clinton streets, has plans in progress for addition to plant at cost of $500,000; work will include warehouse, and addition to factory and offices. Main office of American Can Co., 230 Park avenue, New York.

SONORA, TEX.—City, H. V. Stokes, mayor, votes Jan. 11 on $175,000 bonds for light and power plant. Albert C. Moore & Co., 2404 Smith-Young tower, San Antonio, Tex., consulting engineer.

Kansas

GODDARD, KANS.—Sedgwick county electric co-operative, J. W. Guthrie, superintendent, has awarded contract to Ofstie Construction Co., Spring Valley, Wis., for construction of 196 miles of transmission lines. E. T. Archer & Co., 609 New England building, Kansas City, Mo., consulting engineer (Noted Sept. 16).

North Dakota

GLENFIELD, N. DAK.—REA has allotted $153,000 to Tri-county electric co-operative to finance construction of 206 miles of rural transmission lines.

Nebraska

NAPER, NEBR.—Village, Fred A. Putman, clerk, will be ready for bids in January on rebuilding electric light plant and distribution system to cost about $20,000. H. H. Henningson, 1904 Farnam street, Omaha, Nebr., consulting engineer.

OMAHA, NEBR.—Metropolitan utilities district, Walter Byrne, general manager, plans construction of gas plant boiler unit to house two 500-horsepower boilers.

Iowa

FORT DODGE, IOWA—City, H. R. Sittig, clerk, has retained Buell & Winter, 508 Insurance Exchange building, Sioux City, Iowa, consulting engineers, to prepare plans for construction of sewage plant addition to cost about $150,000.

GREENFIELD, IOWA—REA has approved the awarding of contract by Farmers electric co-operative, Albert Ray, president, to Evans Construction Co., Early, Iowa, at $142,793 for construction of 241 miles of transmission lines. K. R. Brown, 802 Valley Bank building, Des Moines, Iowa, consulting engineer.

MELCHER, IOWA — City, Ora E. Brasher, clerk, approved a $30,000 bond issue at recent election to finance waterworks plant.

RED OAK, IOWA—Nyman electric co-operative will soon take bids on construction of 149 miles of rural electric lines. REA has allotted $135,000 for this project. H. H. Henningson, Service Life building, Omaha, Nebr., consulting engineer.

California

OAKLAND, CALIF.—Gaylord Container Corp., 2820 South Eleventh street, St. Louis, will build a plant on the five-acre site it has acquired here. Total expenditure $600,000.

SAN FRANCISCO — Crane Co., 301 Brannan street, is completing plans for erection of one-story pipe storage plant addition to cost about $42,500. H. B. Hammill, 381 Bush street, engineer.

Montana

LEWISTOWN, MONT.—Fergus electric co-operative, Bruce Shavers, superintendent, is preparing plans and will take bids soon on construction of 173 miles of rural transmission lines. James Garrison, state water conservation board, Helena, Mont., consulting engineer.

MISSOULA, MONT.—Missoula county clerk, W. J. Babington, rejected all bids Dec. 9 and is taking new bids to Jan. 18 on furnishing submersible type deep well turbine pump, electric driven motor, pneumatic storage tank, air injector and other pumping equipment (Noted Dec. 2).

Oregon

PORTLAND, OREG.—Drake, Wyman & Voss are low at $128,775 for construction of cantonment buildings at Fort Columbia and Fort Canby, Oreg. Project involves steam heating, water and sewer systems, electric equipment, pumping machinery and storage tanks.

SPRINGFIELD, OREG.—Halloway & Crabb are building a 40,000-foot daily capacity planing mill and will also install equipment.

Washington

LONGVIEW, WASH.—Bids will be taken Jan. 23 for proposed municipal $85,000 filter plant.

SEATTLE—National Steel Construction Co., J. Wilson, president, 425 Frontenac street, will build plant addition costing $60,000.

SEATTLE—Webster-Brinkley Co., 651 Alaska street, plans machinery plant improvements, including extension of craneway.

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Northwest Steel Rolling Mills, 4315 Ninth Ave., Seattle, Wash.
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Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
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Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BATTERIES (Storage)
Edison, Thomas A., Inc., Orange, N. J.
Electric Storage Battery Co., The, 19th St. and Allegheny Ave., Philadelphia, Pa.
Graybar Electric Co., Graybar Bldg., New York City.

BATTERY CHARGING APPARATUS
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

BEAMS, CHANNELS, ANGLES, ETC.
(*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.

BEAMS, CHANNELS, ANGLES, ETC.—Con.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BEARINGS (Ball)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Torrington Co., The, Torrington, Conn.

BEARINGS (Babbitt)
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

BEARINGS (Brass, Bronze)
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

BEARINGS (Journal)
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Needle)
Torrington Co., The, Torrington, Conn.

BEARINGS (Non-Metallic)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BEARINGS (Oilless)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

BEARINGS (Quill)
Bantam Bearings Corp., South Bend, Ind.

BEARINGS (Radial)
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St., and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The Canton, O.

BEARINGS (Roll Neck)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Morgan Construction Co., Worcester, Mass.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Rolling Mill)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Morgan Construction Co., Worcester, Mass.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Thrust)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BELLS (Furnace)
Pittsburgh Steel Foundry Corp., Glassport, Pa.

BELTING (Chain and Link)
Baldwin-Duckworth Div. of Chain Belt Co., 326 Plainfield St., Springfield, Mass.
Link-Belt Co., 220 So. Belmont Ave., Indianapolis, Ind.

BELTING (Metal, Conveyor, High and Low Temperature)
Cyclone Fence Co., Waukegan, Ill.

BELTING (Rubber)
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.

BENCHES
Challenge Machinery Co., Grand Haven, Mich.

BENCH PLATES
Challenge Machinery Co., Grand Haven, Mich.

BENDING AND STRAIGHTENING MACHINES
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Alliance Machine Co., The, Alliance, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Kardong Bros., Inc., 346 Buchanan St., Minneapolis, Minn.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

BENZOL AND TOLUOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Co., Tar & Chemical Div., 901 Koppers Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS (Alloys and Carbon Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Northwest Steel Rolling Mills, 4315 Ninth Ave., Seattle, Wash.
Republic Steel Corp., Dept. ST, Cleveland, O.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

BILLETS (Forging)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

BILLETS AND BLOOMS (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BINS (Storage)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Petroleum Iron Works Co., Sharon, Pa.

BLAST CLEANING EQUIPMENT (Sand)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

BLAST FURNACE CLEANING (Gas)
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE HOT BLAST STOVES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE SPECIALTIES
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., 1st National Bk. Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

BLAST FURNACE STOCK HOUSES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACES—See FURNACES (Blast)

BLOCKS (Chain)
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

BLOWERS
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Truflo Fan Co., 600 Mercer St., Harmony, Pa.

BLOWPIPES (Oxy-Acetylene)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

BLUE PRINTING MACHINES
Pease, C. F., Co., The, 2688 W. Irving Park Blvd., Chicago, Ill.

BLUE PRINTING SUPPLIES and EQUIPMENT
Pease, C. F., Co., The, 2688 W. Irving Park Blvd., Chicago, Ill.

BOILER HEADS
Bethlehem Steel Co., Bethlehem, Pa.

BOILER TUBES—See TUBES (Boiler)

BOILERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Oil Well Supply Co., Dallas, Texas.

BOLT AND NUT MACHINERY
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., The, Tiffin, O.

BOLTS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*Erie Bolt & Nut Co., Liberty Ave., at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BOLTS (Carriage and Machine)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.

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BOLTS (Carriage & Machine)—Con.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

BOLTS (Special)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS (Stove)
Central Screw Co., 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Townsend Co., New Brighton, Pa.

BOLTS (Stove, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

BOLTS (Track)—See TRACK BOLTS

BOOKS
International Correspondence Schools, Box 9368-B, Scranton, Pa.

BORING MACHINES (Precision)
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.
Sellers, Wm., & Co., Inc., 1622 Hamilton St., Philadelphia, Pa.

BOSH PLATES
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.

BOXES (Annealing)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
National-Erie Corp., Erie, Pa.
National Wrought Iron Annealing Box Co., Washington, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BOXES (Open Hearth Charging)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

BRAKE SHOES
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.

BRAKE LININGS
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.
Johns-Manville Corp., 22 E. 40th St., New York City.

BRAKES (Electric)
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.

BRAKES (Press)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., Wickliffe, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

BRICK—(Insulating)—See INSULATING BRICK

BRICK (Refractory)—See REFRACTORIES, CEMENT, ETC.

BRICK (Ladle)
Globe Brick Co., The, East Liverpool, O.

BRICK (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

BRIDGE CRANES (Ore and Coal Handling)—See CRANES (Bridge)

BRIDGES, BUILDINGS, VIADUCTS, STACKS, ETC.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Blawnox, Pa.
Columbia Steel Co., San Francisco, Calif.
Petroleum Iron Works Co., Sharon, Pa.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

BROACHING CUTTERS
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BROACHING MACHINES
Bullard Co., The, Bridgeport, Conn.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Colonial Broach Co., 147 Jos. Campau, Detroit, Mich.

BRUSHES
Fuller Brush Co., The, Industrial Div., Dept. 8C, Hartford, Conn.

BRUSHES (Industrial)
Fuller Brush Co., The, Industrial Div., Dept. 8C, Hartford, Conn.

BRUSHES (Steelgript)
Fuller Brush Co., The, Industrial Div., Dept. 8C, Hartford, Conn.

BUCKETS (Clam Shell, Dragline Grab, Single Line)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Blaw-Knox Co., Blawnox, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Osgood Co., The, Marion, O.
Owen Bucket Co., 7762 Breakwater St., Cleveland, O.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.

BUCKETS (Single Hook, Automatic Dump, Automatic Single Line)
Erosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Wellman Engineering Co., The, 7000 Central Ave., Cleveland, O.

BUILDINGS (Steel)—See BRIDGES, BUILDINGS, ETC.

BULLDOZERS
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Beatty Machine & Mfg. Co., Hammond, Ind.
Hanniffin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

BURNERS (Acetylene)—See TORCHES AND BURNERS

BURNERS (Automatic)
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BURNERS (Fuel, Oil, Gas, Combination)
American Gas Furnace Co., Elizabeth, N. J.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BUSHINGS (Bronze)
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

BUSHINGS (Jig)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BUSHINGS (Oilless)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

BY-PRODUCT PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

CABINETS (Steel)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

CAISSONS (Pneumatic)
Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh, Pa.

CALCIUM METAL AND ALLOYS
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

CAP SCREWS—See SCREWS (Cap, Set, Safety-Set)

CAR DUMPERS
Alliance Machine Co., The, Alliance, O.
Industrial Brownhoist Corp., Bay City, Mich.

CAR PULLERS and SPOTTERS
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.

CARBIDE
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Carbide Corp., 60 E. 42nd St., New York City.

CARS (Charging)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Engineering Works, New Castle, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

CARS (Cinder Pot)
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Dump)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Industrial and Mining)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Differential Steel Car Co., Findlay, O.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Scale)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

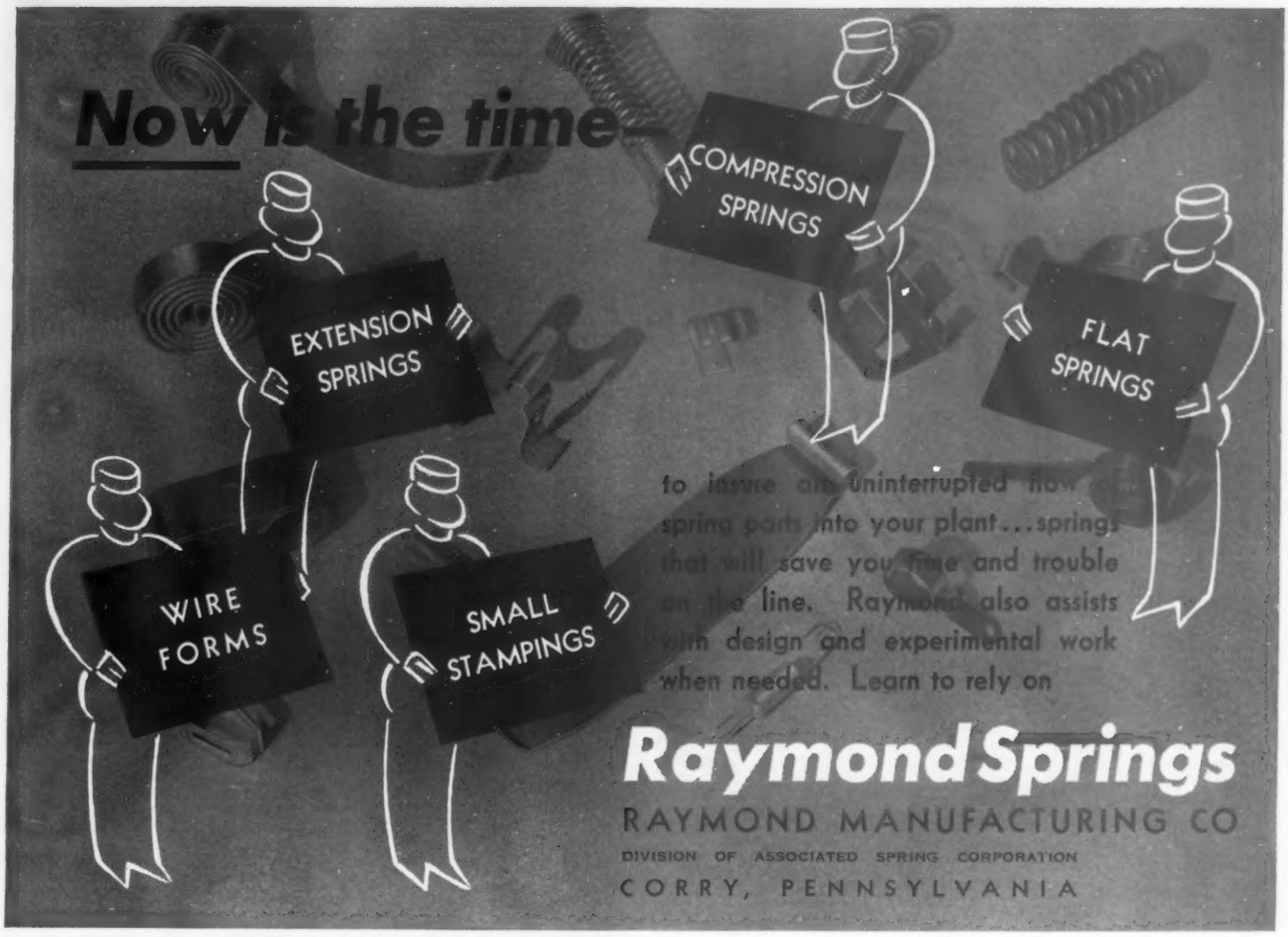
CASTING WASHER EQUIPMENT
Pangborn Corp., Hagerstown, Md.

CASTINGS (Acid Resisting)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
International Nickel Co., Inc., The, 67 Wall St., New York City.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Alloy Iron)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Alloy Steel)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Electro-Alloys Co., The, Elyria, O.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.,
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National-Erie Corp., Erie, Pa.
Ohio Steel Foundry Co., Lima, O. Springfield, O.
Pittsburgh Rolls, Div. of Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Brass, Bronze, Copper, Aluminum)
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.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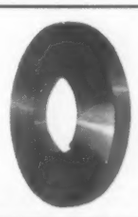

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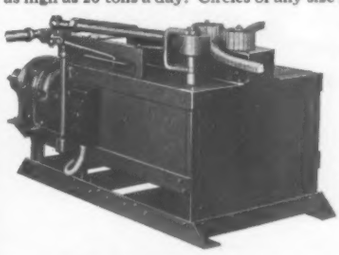

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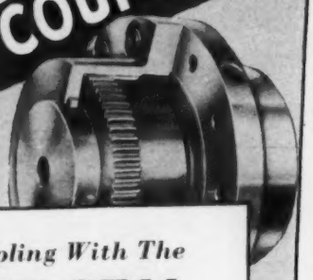

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Morgan Engineering Co., The, Alliance, O.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Corrosion Resisting)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Die)—See DIE CASTINGS

CASTINGS (Electric Steel)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
National-Erie Corp., Erie, Pa.
Reading Steel Casting Div. of American Chain & Cable Co. Inc., Reading, Pa.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Gray Iron, Alloy, or Semi-Steel)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Canton Pattern & Mfg. Co., The, 210 Andrews Pl. S.W., Canton, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Columbia Steel Co., San Francisco, Calif.
Erie Foundry Co., Erie, Pa.
Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Monessen Fdy. & Mach. Co., Monessen, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Oil Well Supply Co., Dallas, Texas.
Shenango-Penn Mold Co., Dover, O.
Urick Foundry Co., 1416-20 Cherry St., Erie, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

CASTINGS (Heat Resisting)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Electro-Alloys Co., The, Elyria, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Malleable)
American Chain & Cable Co. Inc., Bridgeport, Conn.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CASTINGS (Manganese Steel)
Damascus Steel Casting Co., New Brighton, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

CASTINGS (Steel) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O., Springfield, O.
Oil Well Supply Co., Dallas, Texas.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Standard Steel Works Co., Paschall P. O., Philadelphia, Pa.
Steel Founders' Society of America, 920 Midland Bldg., Cleveland, O.
Strong Steel Fdry. Co., Hertel & Norris Ave., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Wear Resisting)
American Brake Shoe & Fdry. Co., The, 230 Park Ave., New York City.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Worm and Gear Bronze)
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

CEMENT (Acid Proof)
Atlas Mineral Products Co., of Pa., Mertztown, Pa.
Pennsylvania Salt Mfg. Co., Dept. E., Pennsalt Cleaner Div., Philadelphia, Pa.
Sauereisen Cements Co., Sharpsburg, Pa.

CEMENT (High Temperature)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Eagle-Picher Lead Co., The, Cincinnati, O.
Falcon Bronze Co., 218 S. Phelps St., Youngstown, O.
Johns-Manville Corp., 22 E. 40th St., New York City.
Norton Company, Worcester, Mass.
Quigley Co., Inc., 56 W. 45th St., New York City.

CEMENT (High Temperature Hydraulic)
Atlas Lumnite Cement Co., Dept. S-10, Chrysler Bldg., New York City.

CENTRAL STATION EQUIPMENT
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

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Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
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CHAIN (Sprocket)
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CHAIN (Steel-Finished Roller)
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CHAIN (Welded or Weldless)
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CHARGING MACHINES (Cupola)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES (Open Hearth)
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES AND MANIPULATORS (Autofloor Type)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

CHECKER BRICK
Loftus Engineering Corp., 509 Oliver Bldg., Pittsburgh, Pa.

CHECKS (Metal)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

CHISELS (Chipping)
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CHROME ORE
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Chromium Mining & Smelting Corp., Ltd., 700 Bank of Commerce Bldg., Hamilton, Ont.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

CHROMIUM PLATING PROCESS
United Chromium, Inc. 51 E. 42nd St., New York City.

CHUCKING MACHINES (Multiple Spindle)
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Cowles Detergent Co., The, Heavy Chemical Div., 7018 Euclid Ave., Cleveland, O.
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Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

CLIPS (Packaging)
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CLUTCHES (Friction)
Jones, W. A. Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.

CLUTCHES (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.

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Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Koppers Co., Gas & Coke Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Coal Co., 300 Koppers Bldg., Pittsburgh, Pa.
New England Coal & Coke Co., Boston, Mass.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wieman & Ward Co., The, Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

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Butler Bin Co., Waukesha, Wis.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Koppers-Rheolaveur Co., 300 Koppers Bldg., Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COILS (Furnace)
Production Plating Works, Inc., The, Lebanon, O.

COKE—See COAL OR COKE

COKE OVEN MACHINERY
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Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
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Worthington Pump & Machinery Corp., Harrison, N. J.

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Youngstown Sheet & Tube Co., The, Youngstown, O.

CONDUITS (Pressure-Treated Wood)
Wood Preserving Corp., The, 300 Koppers Bldg., Pittsburgh, Pa.

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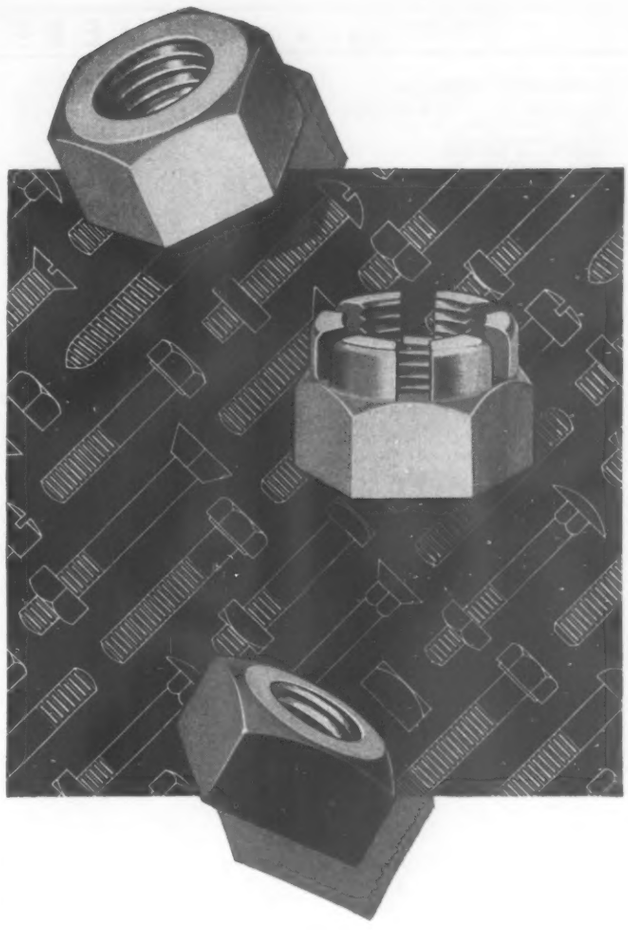

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Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

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Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
General Electric Co., Schenectady, N. Y.

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Mathews Conveyer Co., 114 Tenth St., Ellwood City, Pa.

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Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mathews Conveyer Co., 114 Tenth St., Ellwood City, Pa.

CONVEYORS (Elevating)
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mathews Conveyer Co., 114 Tenth St., Ellwood City, Pa.

CONVEYORS (Overhead Trolley)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.

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Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Mathews Conveyer Co., 114 Tenth St., Ellwood City, Pa.

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Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

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Revere Copper & Brass, Inc., 230 Park Ave., New York City.

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Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

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American Flexible Coupling Co., 18th & Pittsburgh Aves., Erie, Pa.
Baldwin-Duckworth Div. of Chain Belt Co., 326 Plainfield St., Springfield, Mass.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Lovejoy Flexible Coupling Co., 4973 W. Lake St., Chicago, Ill.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.
Poole Fdy. & Mach. Co., Woodberry St., Baltimore, Md.
Waldron, John, Corp., New Brunswick, N. J.

COUPLINGS (Pipe)
Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas
Republic Steel Corp., Dept. ST, Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

CRANES, BRIDGE (Ore and Coal Handling)
Alliance Machine Co., The, Alliance, O.
Dravo Corp. (Engin'r'g Works Div.), Neville Island, Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.

CRANES (Charging)
Alliance Machine Co., The, Alliance, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Crawler, Erection)
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.

CRANES (Electric)
Alliance Machine Co., The, Alliance, O.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Gantry)
Alliance Machine Co., The, Alliance, O.
Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Gasoline and Diesel)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.

CRANES (Hand)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Industrial Brownhoist Corp., Bay City, Mich.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Jib)
Alliance Machine Co., The, Alliance, O.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Locomotive)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.

CRANES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Traveling)
Industrial Equipment Corp., Pittsburgh, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANK SHAFTS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Leard, Wm., Co., Inc., 16th St. & 5th Ave., New Brighton, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

CRUSHERS
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.

CUSHIONS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

CUT-OFF MACHINES (Abrasive)
Challenge Machinery Co., Grand Haven, Mich.

CUTTERS (Die Sinking & End Milling)
Brown & Sharpe Mfg. Co., Providence, R. I.
Tomkins-Johnson Co., 611 N. Mechanic St., Jackson, Mich.

CUTTERS (Gang Slitter)
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.

CUTTING AND WELDING—See WELDING

CUTTING OILS—See OILS (Cutting)

CYLINDERS (Air or Hydraulic)
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Tomkins-Johnson Co., 611 N. Mechanic St., Jackson, Mich.

CYLINDERS (Pressure)
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

DEGREASERS
Detroit Rex Products Co., 13029 Hillview Ave., Detroit, Mich.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

DIE BLOCKS
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Heppenstall Co., 47th and Hatfield Sts., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

DIE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

DIE HEADS
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

DIE-SINKING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

DIES (Cast)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Forgings & Castings Corp., 1350 Jarvis St., Ferndale, Mich.

DIES (Punching, Stamping, Blanking)
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.
Columbus Die, Tool & Mach. Co. 955 Cleveland Ave., Columbus, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

DIES (Steel, Embossing)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

DOLOMITE—FLUX AND REFRACTORIES
Basic Dolomite, Inc., Hanna Bldg., Cleveland, O.

DOORS & SHUTTERS (Steel, Fire, and Rolling)
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Kinnear Mfg. Co., 1780-1800 Fields Ave., Columbus, O.

DOORS & TRIM (Metal)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

DRAGLINES (Crawler)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

DRAFT GAGES (Indicating, Recording)
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

WHERE-TO-BUY

DRAFTING ROOM EQUIPMENT
Pease, C. F., Co., The, 2688 W. Irving Park Blvd., Chicago, Ill.

DRILL HEADS (Multiple)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

DRILL RODS—See RODS (Drill)

DRILLING MACHINES (Radial)
Cincinnati Bickford Tool Co., Oakley Sta., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

DRILLS (Portable-Pneumatic)
Ingersoll-Rand Co., Phillipsburg, N. J.

DRILLS (Twist)—See TWIST DRILLS

DRIVES (Chain)
Chain Belt Co., 1660 W. Bruce St., Milwaukee, Wis.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

DRIVES (Cut Herringbone Gear)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

DRIVES (Multi-V-Belt)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DRIVES (Reciprocating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

DRUMS (Steel)
Petroleum Iron Works Co., Sharon, Pa.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

DRYERS (Compressed Air)
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

DRYERS (Rotary)
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DUST ARRESTING EQUIPMENT
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pangborn Corp., Hagerstown, Md.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

ECONOMIC SERVICE
Brookmire Corp., 551 Fifth Ave., New York City.

ECONOMIZERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

ELECTRIC WELDING—See WELDING

ELECTRIC WIRING—See WIRE AND CABLE

ELECTRICAL EQUIPMENT
Allen-Bradley Co., 1320 So. Second St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Graybar Bldg., New York City.

ELECTRODES (Carbon and Graphite)
National Carbon Co., W. 117th St. at Madison Ave., Cleveland, O.

ELECTRODES (Hard Surfacing Welding)
Stoody Co., Whittier, Calif.

ELEVATING AND CONVEYING MACHINERY—See CONVEYORS

ENGINEERS AND CONTRACTORS
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Hunt, C. H., 1213 1st National Bank Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

ENGINEERS (Consulting)
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Hunt, C. H., 1213 1st National Bank Bldg., Pittsburgh, Pa.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Lindemuth, Lewis B., 140 Cedar St., New York City.
Loftus Engineering Corp., 509 Oliver Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Wean Engineering Co., Warren, O.

ENGINES (Diesel)
Cooper-Bessemer Corp., Mt. Vernon, O.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Gas, Oil)
Fairbanks, Morse & Co., Dept. 96, 600 So. Michigan Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES (Kerosene)
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Steam)
Oil Well Supply Co., Dallas, Texas.

EXCAVATORS
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Osgood Co., The, Marion, O.

FANS (Crane Cab)
Graybar Electric Co., Graybar Bldg., New York City.
Perkins, B. F. & Son, Inc., Holyoke, Mass.
Truflo Fan Co., 600 Mercer St., Harmony, Pa.

FANS (Exhaust Ventilating)
Graybar Electric Co., Graybar Bldg., New York City.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Truflo Fan Co., 600 Mercer St., Harmony, Pa.

FANS (High Temperature)
Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.

FANS (Portable)
Graybar Electric Co., Graybar Bldg., New York City.
Perkins, B. F., & Son, Inc., Holyoke, Mass.
Truflo Fan Co., 600 Mercer St., Harmony, Pa.

FANS (Wall)
Graybar Electric Co., Graybar Bldg., New York City.
Perkins, B. F. & Son, Inc., Holyoke, Mass.
Truflo Fan Co., 600 Mercer St., Harmony, Pa.

FENCE (Chain Link)
Cyclone Fence Co., Waukegan, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.

FENCING (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

FERROALLOY (Briquets)
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

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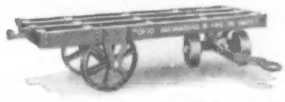
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Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

FERROCHROME
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank & Co., Inc. Harrison Bldg., Philadelphia, Pa.

FERROMANGANESE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERROPHOSPHORUS
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa

FERROSILICON
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Southern Ferro Alloys Co., 2108 Chestnut St., Chattanooga, Tenn.

FERROTITANIUM
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

FERROVANADIUM
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

FILES AND RASPS
Simonds Saw & Steel Co., Fitchburg, Mass.

FILING CABINETS (Blueprint, Drawing and Tracing)
Pease, C. F., Co., The, 2688 W. Irving Park Blvd., Chicago, Ill.

FILTER CLOTH (Asbestos)
Johns-Manville Corp., 22 E. 40th St., New York City.

FIRE CLAY—See REFRACTORIES
FIRE DOORS & SHUTTERS—See DOORS & SHUTTERS

FITTINGS (Electric Steel)
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

FLAME HARDENING
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., 30 E. 42nd St., New York City.
National-Erie Corp., Erie, Pa.

FLANGES (Welded Steel)
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.

FLOOR RESURFACING
Flexrock Co., 2330 Manning St., Philadelphia, Pa.
United Maintenance Sales Co., 311 Ross St., Pittsburgh, Pa.

FLOORING (Monolithic)
Carey, Philip, Co., The, Dept. 71 Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

FLOORING (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Standard Steel Spring Co., Gary, Ind.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

FLUE DUST CONDITIONERS
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

FLUE GAS ANALYZERS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

FLUORSPAR
Hillside Fluor Spar Mines, 38 S. Dearborn St., Chicago, Ill.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FLUXES (Soldering, Welding & Tinning)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Anti-Borax Compound Co., Inc., Fort Wayne, Ind.
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

FORGING BILLETS—See BILLETS
FORGING MACHINERY
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Alliance Machine Co., The, Alliance, O.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.

FORGING ROLLS
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.

FORGINGS (Brass, Bronze, Copper)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.

FORGINGS (Drop) (*Also Stainless)
American Forge Div. of The American Brake Shoe & Fdry. Co., 2621 So. Hoyne Ave., Chicago, Ill.
*Atlas Drop Forge Co., Lansing, Mich.
*Bethlehem Steel Co., Bethlehem, Pa.
Oil Well Supply Co., Dallas, Texas.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Hollow Bored)
Ajax Steel & Forge Co., 205 Adair St., Detroit, Mich.
Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

FORGINGS (Iron and Steel) (*Also Stainless)
American Forge Div. of The American Brake Shoe & Fdry. Co., 2621 S. Hoyne Ave., Chicago, Ill.
*Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa
Forgings & Castings Corp., 1350 Jarvis St., Ferndale, Mich.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Leard, Wm., Co., Inc., 16th St. & 5th Ave., New Brighton, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Oil Well Supply Co., Dallas, Texas.
Standard Steel Works Co., Paschall P. O., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Upset)
American Forge Div. of The American Brake Shoe & Fdry. Co., 2621 So. Hoyne Ave., Chicago, Ill.
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem Steel Co., Bethlehem, Pa.

FROGS AND SWITCHES
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

FURNACE BOTTOMS
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

FURNACE INSULATION—See INSULATION

FURNACES (Blast)
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pennsylvania Engineering Works, New Castle, Pa.
Pollock, Wm. B. Co., The, 101 Andrews Ave., Youngstown, O.

FURNACES (Brazing)
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.

FURNACES (Electric Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

FURNACES (Electric Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Forging)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Galvanizing)
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.

FURNACES (Gas or Oil)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Heat Treating, Annealing, Carburizing, Hardening, Tempering)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Gas Furnace Co., Elizabeth, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Carborundum Co., The, Perth Amboy, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

FURNACES (Laboratory)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.

FURNACES (Non-Ferrous Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.

FURNACES (Open Hearth)
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Lindemuth, Lewis B., 140 Cedar St., New York City.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pennsylvania Engineering Works, New Castle, Pa.

FURNACES (Recuperative)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J. Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Rivet Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Sheet and Tin Mill)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

FURNACES (Steel Mill)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

GAGE BLOCKS
Dearborn Gage Co., 22036 Beech St., Dearborn, Mich.

GAGES
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Sheffield Gage Corp., 1528 E. Third St., Dayton, O.

GAGES (Indicating and Recording)
General Electric Co., Schenectady, N. Y.
Sheffield Gage Corp., 1528 E. Third St., Dayton, O.

GALVANIZING (Hot Dip)
Acme Galvanizing, Inc., Milwaukee, Wis.

WHERE-TO-BUY

GALVANIZING (Hot Dip)—Con.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Hot Dip Galvanizers Assoc., Inc., 903 American Bank Bldg., Pittsburgh, Pa.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Steel Co., Atlanta, Ga.
Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N. Y.
Cattie, Jos. P., & Bros., Gaul and Liberty Sts., Philadelphia, Pa.
Commercial Metals Treating, Inc., Toledo, O.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Equipment Steel Div., of Union Asbestos & Rubber Co., Blue Island, Ill.
Fanner Mfg. Co., The, Cleveland, O.
Finn, John, Metal Works, San Francisco, Calif.
Gregory, Thomas, Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.
Hubbard & Co., Oakland, Calif.
Independent Galvanizing Co., Newark, N. J.
International-Stacey Corp., Columbus, O.
Isaacson Iron Works, Seattle, Wash.
Joslyn Co. of California, Los Angeles, Calif.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Koven, L. O., & Bro., Inc., Jersey City, N. J.
Lehigh Structural Steel Co., Allentown, Pa.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Missouri Rolling Mill Corp., St. Louis, Mo.
National Telephone Supply Co., The, Cleveland, O.
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Calif.
Sanitary Tinning Co., The, Cleveland, O.
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
Witt Cornice Co., The, Cincinnati, O.

GALVANIZING PLANTS FOR SHEETS
Erie Foundry Co., Erie, Pa.
Wean Engineering Co., Warren, O.

GAS HOLDERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GAS PRODUCER PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

GAS RECOVERY COKE OVEN AND GAS PLANTS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

GAS SCRUBBERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GASKETS (Asbestos, Metal or Rubber)
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.
Johns-Manville Corp., 22 E. 40th St., New York City.

GEAR BLANKS
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEAR MACHINERY (Generating)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

GEAR MACHINERY (Lapping, Finishing, Checking)
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

GEARS (Non-Metallic)
Abart Gear & Machine Co., 4825 W. 16th St., Chicago, Ill.
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.

GEARS (Steel Laminated)
Waldron, John, Corp., New Brunswick, N. J.

GEARS (Worm)
Abart Gear & Machine Co., 4825 W. 16th St., Chicago, Ill.
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS AND GEAR CUTTING
Abart Gear & Machine Co., 4825 W. 16th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Grant Gear Works, 2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466 Pittsburgh, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
National-Erie Corp., Erie, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., 25th St., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

GENERATING SETS
Electric Generator & Motor Co., 4519 Hamilton Ave., Cleveland, O.
Fairbanks, Morse & Co., Dept. 98, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Acetylene—Portable and Stationary)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

GENERATORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GRABS—FOR SHEETS, COILS, INGOTS
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

GRAPPLES (Scrap Handling)
Owen Bucket Co., 7762 Breakwater St., Cleveland, O.

GRATING
Blaw-Knox Co., Blawnox, Pa.
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.

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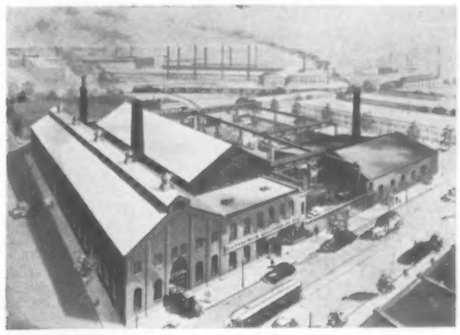

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THE ERDLE PERFORATING CO.
171 York Street Rochester, N.Y.

GRATING—Con.
Standard Steel Spring Co., Gary, Ind.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

GREASE (Lubricating)—See LUBRICANTS (Industrial)

GREASE RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

GRINDERS (Foundry Core)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

GRINDERS (Portable-Pneumatic)
Ingersoll-Rand Co., Phillipsburg, N. J.

GRINDERS (Precision Thread)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Jones & Lamson Machine Co., Springfield, Vt.

GRINDERS (Single Slide Internal)
Bryant Chucking Grinder Co., Springfield, Vt.

GRINDERS (Surface)
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
Norton Company, Worcester, Mass.

GRINDERS (Swing Frame)
Fox Grinders, Inc., Oliver Bldg., Pittsburgh, Pa.

GRINDER CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

GRINDING COMPOUNDS
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

GRINDING MACHINES (Automotive Reconditioning)
Heald Machine Co., Worcester, Mass.
Landis Tool Company, Waynesboro, Pa.

GRINDING MACHINES (Centerless, Internal and External)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Chucking)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Heald Machine Co., Worcester, Mass.
Landis Tool Company, Waynesboro, Pa.

GRINDING MACHINES (Crank Pin, Cam, Piston & Valve Face)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Landis Tool Company, Waynesboro, Pa.
Norton Company, Worcester, Mass.

GRINDING MACHINES (Oscillating)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Landis Tool Company, Waynesboro, Pa.

GRINDING MACHINES (Plain and Universal)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Landis Tool Company, Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Roll)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Landis Tool Co., Waynesboro, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Rotary Surface)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Tool and Cutter)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.
Sellers, Wm., & Co., Inc., 1622 Hamilton St., Philadelphia, Pa.

GRINDING MACHINES (Swing Frame)
Excelsior Tool & Machine Co., Ridge & Jefferson Aves., E. St. Louis, Ill.

GRINDING (Shear Knife)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

GRINDING WHEELS
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

GRINDING WHEELS (Segmental)
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

GUARDS (Belt, Machine & Window)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.

GUIDE SHOES
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUIDES (Mill)
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUNS (Blast Furnace Mud)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

GUNS (Steam, Hydraulic, Electric)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

HAMMER BUSHINGS
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

HAMMER BOARDS (Drop)
Detroit Drop Hammer Board Co., 3824 Grand River Ave., Detroit, Mich.

HAMMERS (Chipping, Riveting, Calking)
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS (Drop)
Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HAMMERS (Power)
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

HAMMERS (Steam)
Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HANGERS
Grinnell Co., Inc., Providence, R. I.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HANGERS (Shaft)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
New Departure Div., General Motors Corp., Bristol, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HEADING MACHINERY
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland, O.
National Machinery Co., Tiffin, O.

HEATERS (Air)
Airtherm Manufacturing Co., 726 S. Spring Ave., St. Louis, Mo.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

HEATERS (Electric Space)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

HEATERS (Unit)
Airtherm Manufacturing Co., 726 S. Spring Ave., St. Louis, Mo.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Grinnell Co., Inc., Providence, R. I.

HEAT TREATING
Commercial Metals Treating, Inc., Toledo, O.

HELMETS (Blast Cleaning)
Pangborn Corp., Hagerstown, Md.

HITCHINGS (Mine Car)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOBS
Brown & Sharpe Mfg. Co., Providence, R. I.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

HOISTS (Chain)
Ford Chain Block Div. of American Chain & Cable Co., Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Electric)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Monorail)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Pneumatic)
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.

HOOKS (Chain)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOOPS AND BANDS
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

HOSE (Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

HUMIDIFIERS (Industrial)
Grinnell Co., Inc., Providence, R. I.

HYDRAULIC MACHINERY
Alliance Machine Co., The, Alliance, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Treadwell Construction Co., Midland, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

HYDRAULIC PRESSES—See PRESSES (Hydraulic)

HYDRAULIC UNITS
Barnes, W. F. & John, Co., 201 So. Water St., Rockford, Ill.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

INDICATORS (Blast Furnace Stock Line)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

INDICATORS (Temperature)
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

INGOT METALS
Roessing Bronze Co., Butler Plank Road, Etna, Pittsburgh, Pa.

INGOT MOLDS
Bethlehem Steel Co., Bethlehem, Pa.
Shenango-Penn Mold Co., Oliver Bldg., Pittsburgh, Pa.
Superior Mold & Iron Co., Penn, Pa.
Valley Mould & Iron Corp., Hubbard, O.

INHIBITORS
American Chemical Paint Co., Dept. 310, Ambler, Pa.

INSTRUMENTS (Electric Indicating and Recording)
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Graybar Bldg., New York City.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

INSULATING BLOCK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City

INSULATING BRICK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., Inc., 56 W. 45th St., New York City.

WHERE-TO-BUY

INSULATING CONCRETE
Atlas Lumnite Cement Co., Dept. S-10, Chrysler Bldg., New York City.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATING POWDER AND CEMENT
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Building)
Carey, Philip, Co., The, Dept. 71. Lockland, Cincinnati, O.
Eagle-Picher Lead Co., The, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Furnace, Boiler Settings, Ovens, Steam Pipe, Etc.)
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., Inc., 56 W. 45th St., New York City.

IRON (Bar)
Ryerson, Jos. T., & Son Co., 16th & Rockwell Sts., Chicago, Ill.

IRON (Swedish)
Swedish-American Steel Corp., 430 Kent Ave., Brooklyn, N. Y.

IRON ORE
Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

JIGS AND FIXTURES
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.

KETTLES (Galvanizing)
National Wrought Iron Annealing Box Co., Washington, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B. Co., The, 101 Andrews Ave., Youngstown, O.

KEYS (Machine or Woodruff)
Leard, Wm., Co., Inc., 16th St. & 5th Ave., New Brighton, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.

KILNS (Rotary Sintering)
Smidth, F. L., & Co., 225 Broadway, New York City.

KNIVES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.

LABORATORY WARE
Bay State Abrasive Products Co., Westboro, Mass.
Norton Company, Worcester, Mass.

LADLES
Hollands Mfg. Co., 342-352 E. 18th St., Erie, Pa.
Pennsylvania Engineering Works, New Castle, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

LAMPS (Industrial)
General Electric Co., Dept. 166-S-L, Nela Park, Cleveland, O.

LAPPING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Norton Company, Worcester, Mass.

LAPPING PLATES
Challenge Machinery Co., Grand Haven, Mich.

LARRIES (Coal)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.

LATHE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

LATHE DOGS (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

LATHES
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, 654 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Automatic)
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Monarch Machine Tool Co., Sidney, O.

LATHES (Chucking)
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.

LATHES (Engine)
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, 654 E. Madison St., South Bend, Ind.

LATHES (Roll Turning)
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Railroad Car & Driving Wheel)
Sellers, Wm., & Co., Inc., 1622 Hamilton St., Philadelphia, Pa.

LATHES (Turret)
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LAYOUT SURFACE PLATES
Challenge Machinery Co., Grand Haven, Mich.

LEAD (Chemical, Corroding, Desilvered)
St. Joseph Lead Co., 250 Park Ave., New York City.

LEAD (Tellurium)
National Lead Co. 111 Broadway, New York City. . .

LEVELING MACHINES
Erie Foundry Co., Erie, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
McKay Machine Co., Youngstown, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

LIFT TRUCKS—See TRUCKS (Lift)

LIFTING MAGNETS—See MAGNETS (Lifting)

LIGHTING (Industrial)
General Electric Co., Dept., 166-S-L, Nela Park, Cleveland, O.
Graybar Electric Co., Graybar Bldg., New York City.

LINERS (Pump and Cylinder)
Shenango-Penn Mold Co., Dover, O.

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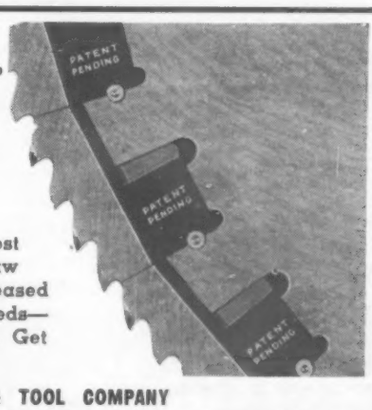

PITTSBURGH SAW & TOOL COMPANY
78-80 SYCAMORE ST., ETNA P. O., PITTSBURGH, PA.

LOCOMOTIVE CRANES—See CRANES (Locomotive)

LOCOMOTIVES (Diesel-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Differential Steel Car Co., Findlay, O.
Plymouth Locomotive Works, Div. Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Diesel Mechanical)
Brookville Locomotive Co., Brookville, Pa.
Plymouth Locomotive Works, Div. Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Electric Trolley)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Fireless)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Gasoline-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gasoline Mechanical)
Brookville Locomotive Co., Brookville, Pa.
Differential Steel Car Co., Findlay, O.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
Ingersoll-Rand Co., Phillipsburg, N. J.

LOCOMOTIVES (Steam)
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Storage Battery)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Switching & Transfer)
Cooper-Bessemer Corp., The, Mt. Vernon, O.

LUBRICANTS (Industrial)
American Lanolin Corp., Railroad St., Lawrence, Mass.
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York City.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Pure Oil Co., The, 35 E. Wacker Dr., Chicago, Ill.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

LUBRICATING SYSTEMS
Farval Corp., The, 3270 E. 80th St., Cleveland, O.

MACHINE WORK
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

MACHINERY (Special)
Alliance Machine Co., The, Alliance, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Barnes, W. F., & John, Co., 201 So. Water St., Rockford, Ill.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Brosius, Edgar E., Inc., Sharpsburgh Branch, Pittsburgh, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa
Morgan Engineering Co., The, Alliance, O.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
National-Erie Corp., Erie, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Oil Well Supply Co., Dallas, Texas.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Sellers, Wm., & Co., Inc., 1622 Hamilton St., Philadelphia, Pa.
Shuster, F. B., Co., The, New Haven, Conn.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

MACHINERY (Used & Rebuilt)
Emerman, Louis E., & Co., 1761 Elston Ave., Chicago, Ill.
Marr-Galbreath Machinery Co., 53 Water St., Pittsburgh, Pa.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

MAGNESIA (Electrically Fused)
Norton Co., Worcester, Mass.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS (Lifting)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MAGNETS (Separating)
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MANDRELS (Expanding)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

MANGANESE METAL AND ALLOYS
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

MANGANESE ORE
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

MANIFOLDS (Gas)
Production Plating Works, Inc., The, Lebanon, O.

MANIPULATORS
Alliance Machine Co., The, Alliance, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

MARKING DEVICES
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

METAL (Perforated)—See PERFORATED METAL

METAL BLAST ABRASIVES (Shot and Grit)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.

METAL CLEANERS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Cowles Detergent Co., The, Heavy Chemical Div., 7018 Euclid Ave., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

METAL FINISHES
American Nickeloid Co., 1310 N. Second St., Peru, Ill.

METAL SPECIALTIES AND PARTS—See STAMPINGS

METAL STAMPINGS—See STAMPINGS

METALS (Hard Surfacing)
Stoody Co., Whittier, Calif.

METALS (Nonferrous)
American Brass Co., The, Waterbury, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

MICROMETERS
Brown & Sharpe Mfg. Co., Providence, R. I.

MICROMETERS (Dial)
Haines Gauge Co., 127 E. Mermaid Lane, Philadelphia, Pa.

MILL BUILDINGS
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.

MILLING CUTTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Sellers, Wm., & Co., Inc., 1622 Hamilton St., Philadelphia, Pa.

MILLING MACHINES (Milling and Centering Combined)
Jones & Lamson Machine Co., Springfield, Vt.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar, Strip, Etc.)—See ROLLING MILL EQUIPMENT

MOLDING MACHINERY (Foundry)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

MOLDINGS (Metal)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

MOLDS (Ingot)—See INGOT MOLDS

MOLYBDENUM
Climax Molybdenum Co., 500 Fifth Ave., New York City.

MONEL METAL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

MONORAIL SYSTEMS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

MOTORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. 96, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Graybar Bldg., New York City.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

MUCK BAR
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

NAILS
(*Also Stainless)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

NAILS (Coated and Galvanized)
Wickwire Brothers, 189 Main St., Cortland, N. Y.

NAILS (Special Only—All Metals)
Townsend Co., New Brighton, Pa.

NICKEL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL (Shot)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL ANODES
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.

NICKEL STEEL (Cold Drawn)
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Republic Steel Co., Dept. ST, Cleveland, O.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

NOZZLES (Blasting)
Pangborn Corporation, Hagerstown, Md.

NUTS
(*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

NUTS (Castellated)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Machine Screw)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.

NUTS (Self Locking)
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.

WHERE-TO-BUY

NUTS (Semi-Finished)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Wing)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

OIL RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.

OILS (Cutting)
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Pure Oil Co., The, 35 E. Wacker Dr., Chicago, Ill.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

OILS (Lubricating)—See LUBRICANTS (Industrial)

OILS (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

OPEN-HEARTH FURNACES—See FURNACES (Open-Hearth)

OVENS (Annealing, Japanning, Tempering)
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., 1106 So. Central Ave., Chicago, Ill.

OVENS (Coke, By-Product Recovery)
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

OVENS (Core and Mold)
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

OXY-ACETYLENE WELDING AND CUTTING—See WELDING

OXYGEN IN CYLINDERS
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

PACKING (Asbestos or Rubber)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.
Johns-Manville Corp., 22 E. 40th St., New York City.

PACKINGS—MECHANICAL LEATHER (Cup, U-Cup, Flange and Vees)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Excelsior Leather Washer Mfg. Co., Inc., Rockford, Ill.
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.

PAINT (Alkali Resisting)
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

PAINT (Aluminum)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Heat Resisting)
American Chemical Paint Co., Dept. 310, Ambler. Pa.

PAINT (Industrial)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.

PAINT (Marking)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAPER
Morris Paper Co., 40th & Butler Sts., Pittsburgh, Pa.

PARALLELS
Challenge Machinery Co., Grand Haven, Mich.

PARTS (Precision)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

PATTERN EQUIPMENT (Wood or Metal)
Wellman Bronze & Aluminum Co., The, 6017 Superior Ave., Cleveland, O.

PENSTOCKS
Treadwell Construction Co., Midland, Pa.

PERFORATED METAL
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

PHENOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

PICKLING COMPOUNDS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

PICKLING CRATES
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Youngstown Welding & Engineering Co., The, Youngstown, O.

PICKLING EQUIPMENT
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
International Nickel Co., The, 67 Wall St., New York City.
Youngstown Welding & Engineering Co., The, Youngstown, O.

PICKLING MACHINERY
Erie Foundry Co., Erie, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

PICKLING TANK LININGS
Atlas Mineral Products Co., of Pa., Mertztown, Pa.
Ceilcote Co., 750 Rockefeller Bldg., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

PICKLING TANKS—See TANKS (Pickling)

PIERCER POINTS
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIG IRON
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Jackson Iron & Steel Co., Jackson, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wieman & Ward Co., The, Oliver Bldg., Pittsburgh, Pa.

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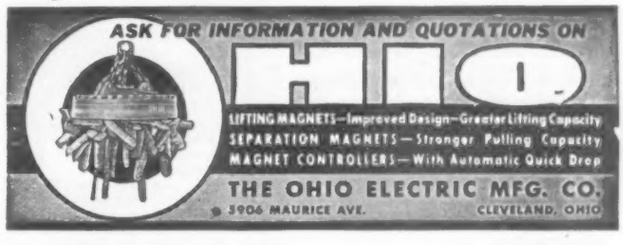
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United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

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Denison Engineering Co., The, 113 W. Chestnut St., Columbus, O.
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Progressive Welder Co., 3031 E. Outer Drive, Detroit, Mich.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

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Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

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Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The Youngstown, O.

RODS (Steel and Iron)
Firth-Sterling Steel Co., McKeesport, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.

RODS (Welding)—See WELDING RODS

RODS (Wire)—See WIRE PRODUCTS

ROLL FORMING MACHINES
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.

ROLLER LEVELERS (Backed-up)
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.

ROLLING DOORS & SHUTTERS—See DOORS AND SHUTTERS

ROLLING MILL BEARINGS—See BEARINGS (Rolling Mill)

ROLLING MILL EQUIPMENT
Alliance Machine Co., The, Alliance, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., The, Alliance, O.
National Roll & Foundry Co., The, Avonmore, Pa.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Streine Tool & Mfg. Co., New Bremen, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

ROLLING MILLS (Consulting, Contracting Engineers)
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

ROLLS (Bending and Straightening)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

ROLLS (Sand and Chilled)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O. Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Steel and Iron)
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hyde Park Fdry. and Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O. Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Tinning Machine)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

ROOFING AND SIDING
Continental Steel Corp., Kokomo, Ind.
Johns-Manville Corp., 22 E. 40th St., New York City.

ROOFING AND SIDING (Corrugated and Plain)
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
New Jersey Zinc Co., 160 Front St., New York City.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Sons, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

ROOFING (Plastic and Liquid)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

RUBBER GOODS (Mechanical)
Garlock Packing Co., The, S 3-40, Palmyra, N. Y.

RUST PREVENTIVES
Alrose Chemical Co., 80 Clifford St., Providence, R. I.
American Chemical Paint Co., Dept. 310, Ambler, Pa.
American Lanolin Corp., Railroad St., Lawrence, Mass.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

RUST PROOFING PROCESS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

SAFE ENDS (Boiler Tube)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

SAFETY DEVICES
Junkin Safety Appliance Co., 10th & Hill Sts., Louisville, Ky.
Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, O.

SAFETY DEVICES (Electric)
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.

SALT TABLETS
Morton Salt Co., 310 So. Michigan Ave., Chicago, Ill.

SAND (Annealing Box Sealing)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND CONDITIONING AND PREPARING MACHINERY
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SAND (Molding)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Slag Pocket)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Silica)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SANDBLAST ABRASIVES (Sand)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAWING MACHINES (Hot and Cold)
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SAWING MACHINES (Contour)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

SAWS (Band—Metal Cutting)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hack)
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hot and Cold)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.

SAWS (Inserted Tooth, Cold)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Metal Cutting)
Brown & Sharpe Mfg. Co., Providence, R. I.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SAWS (Segment)
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.

SCAFFOLDING (Tubular)
Dravo Corp. (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

SCALES
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Fairbanks, Morse & Co., Dept. 96 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.
Toledo Scale Co., 3216 Monroe St., Toledo, O.

SCALES (Dial & Recording)
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

SCALES (Laboratory)
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

SCALES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Fairbanks, Morse & Co., Dept. 96, 600 So. Michigan Ave., Chicago, Ill.

WHERE-TO-BUY

SCALES (Monorail)—Con.
Kron Co., The, Bridgeport, Conn.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Toledo Scale Co., 3216 Monroe St., Toledo, O.

SCALING TOOLS (Pneumatic)
Ingersoll-Rand Co., Phillipsburg, N. J.

SCHOOLS
International Correspondence Schools, Box 9368-B, Scranton, Pa.

SCRAP BALING PRESSES—See BALING PRESSES

SCREENS AND SIEVES
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SCREENS (Vibrating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SCREW EXTRACTORS
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Hindley Mfg. Co., Valley Falls, R. I.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

SCREW MACHINES (Automatic, Single and Multiple Spindle)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Machine Co., Windsor, Vt.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW STOCK—See STEEL (Screw Stock)

SCREWS
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Townsend Co., New Brighton, Pa.

SCREWS (Cap, Set, Safety-Set)
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

SCREWS (Cold Headed)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Townsend Co., New Brighton, Pa.

SCREWS (Conveyor)
Lee Spring Co. Inc., 30 Main St., Brooklyn, N. Y.

SCREWS (Drive)
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Townsend Co., New Brighton, Pa.

SCREWS (Hardened Self-Tapping)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Machine)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Triplex Screw Co., 5341 Grant Ave., Cleveland, O.

SCREWS (Machine, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

SCREWS (Self Locking)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Sheet Metal, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SCREWS (Socket, Cold Forged)
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Thread-Cutting)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Thumb)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Wood, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.

SEAMLESS STEEL TUBING—See TUBES

SEPARATORS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

SHAFT HANGERS—See HANGERS (Shaft)

SHAFTING
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHAKERS
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SHAPERS
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.

SHAPES (Brass, Bronze, Nickel Silver)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

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SHAPES (Steel)—See STEEL (Structural)

SHAPES, SPECIAL (Steel)
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Fort Pitt Spring Co., P. O. Box 1377, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHEAR BLADES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Wapakoneta Machine Co., The, Wapakoneta, O.

SHEARS
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hallden Machine Co., The, Thomaston, Conn.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Streine Tool & Mfg. Co., New Bremen, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SHEARS, ROTARY (Slitting, Beveling, Circling, Flanging)
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

SHEET BARS
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pitsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEET LIFTERS AND CARRIERS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

SHEET METAL PRODUCTS—See STAMPINGS

SHEET METAL WORKERS MACHINES
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Excelsior Tool & Machine Co., Ridge & Jefferson Aves., E. St. Louis, Ill.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

SHEET STEEL PILING (New and Used)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Industrial Equipment Corp., Pittsburgh, Pa.

SHEETS (Acid Resisting)
International Nickel Co., Inc., The, 67 Wall St., New York City.

SHEETS (Black)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The, Newport, Ky.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Parkersburg Iron & Steel Co., The, Parkersburg, W. Va.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.

SHEETS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-16, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.

SHEETS (Corrugated)
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The Youngstown, O.

SHEETS (Deep Drawing and Stamping)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Electrical)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc. Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Galvanized)
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Parkersburg Iron & Steel Co., The, Parkersburg, W. Va.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.
Weirton Steel Co., Weirton, W. Va.

SHEETS (Hot Rolled and Hot Rolled Annealed)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Lead Coated)
Superior Sheet Steel Div. Continental Steel Corp., Canton, O.

SHEETS (Long Terne)
Andrews Steel Co., The, Newport, Ky.
Continental Steel Corp., Kokomo, Ind.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Manganese Steel)
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

SHEETS (Nickel Silver)
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.

SHEETS (Perforated)
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.

SHEETS (Phosphor Bronze)
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.

SHEETS (Reinforced)
Erdle Perforating Co., 171 York St., Rochester, N. Y.

SHEETS (Roofing)—See ROOFING AND SIDING

SHEETS (Stainless)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Massillon, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

SHEETS (Stainless Clad)
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

SHEETS (Tin)—See TIN PLATE

SHEETS (Tin Mill Black)
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va

SHEETS—HIGH FINISH (Automobile, Metal Furniture, Enameling)
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WHERE-TO-BUY

SHELLS (Seamless Drawn)
Crosby Co., The,
183 Pratt St., Buffalo, N. Y.

SHOT (Copper)
Roessing Bronze Co.,
Butler Plank Road, Etna,
Pittsburgh, Pa.

SHOVELS (Power)
Northwest Engineering Co.,
28 E. Jackson Blvd., Chicago, Ill.

SIEVES—See SCREENS AND SIEVES

SIGNALING & INTER-COMMUNICATION EQUIPMENT
Graybar Electric Co., Graybar Bldg., New York City.

SILICO-MANGANESE
Electro Metallurgical Sales Corp.,
30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp.,
Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc.,
Harrison Bldg., Philadelphia, Pa.

SILICON METAL AND ALLOYS
Electro Metallurgical Sales Corp.,
30 E. 42nd St., New York City.
Revere Copper & Brass, Inc.,
230 Park Ave., New York City.

SKELP (Steel)
Alan Wood Steel Co.,
Conshohocken, Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Inland Steel Co.,
38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg.,
St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

SLAG GRANULATING MACHINES (Blast Furnace and Open Hearth)
Broslus, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

SMALL TOOLS
Brown & Sharpe Mfg. Co.,
Providence, R. I.
Cleveland Twist Drill Co., The,
1242 E. 49th St., Cleveland, O.

SOAKING PITS
Amsler-Morton Co., The,
Fulton Bldg., Pittsburgh, Pa.
Salem Engineering Co.,
714 S. Broadway, Salem, O.
Surface Combustion Corp.,
2375 Dorr St., Toledo, O.

SOLDER
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
Wayne Chemical Products Co.,
9502 Copeland St., Detroit, Mich.

SOLENOIDS (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

SOLVENT (Degreasing)
Detroit Rex Products Co.,
13029 Hillview Ave.,
Detroit, Mich.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div.,
Philadelphia, Pa.

SPACING TABLES
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

SPECIAL MACHINERY—See MACHINERY (Special)

SPEED REDUCERS
Abart Gear & Machine Co.,
4825 W. 16th St., Chicago, Ill.
Cleveland Worm & Gear Co.,
3270 E. 80th St., Cleveland, O.
Farrel-Birmingham Co., Inc.,
110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Grant Gear Works,
2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The,
5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co.,
1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co.,
4437 Roosevelt Rd., Chicago, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Michigan Tool Co.,
7171 E. McNichols Rd.,
Detroit, Mich.
New Departure Div., General Motors Corp., Bristol, Conn.

SPELTER (Zinc)
St. Joseph Lead Co., 250 Park Ave., New York City.

SPIEGELEISEN
Electro Metallurgical Sales Corp.,
30 E. 42nd St., New York City.
New Jersey Zinc Co.,
160 Front St., New York City.
Samuel, Frank, & Co., Inc.,
Harrison Bldg., Philadelphia, Pa.

SPIKES (Screw)
Bethlehem Steel Co.,
Bethlehem, Pa.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Columbia Steel Co.,
San Francisco, Calif.
Republic Steel Corp., Dept. ST,
Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

SPINDLES
Leard, Wm., Co., Inc., 16th St. & 5th Ave., New Brighton, Pa.

SPINDLES (Grinding)
Bryant Chucking Grinder Co.,
Springfield, Vt.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co.,
Worcester, Mass.

SPLICE BARS (Rail)
Bethlehem Steel Co.,
Bethlehem, Pa.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Columbia Steel Co.,
San Francisco, Calif.
Inland Steel Co.,
38 So. Dearborn St., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg.,
Birmingham, Ala.

SPRINGS
(*Also Stainless)
American Spiral Spring & Mfg. Co.,
5540 Harrison St.,
Pittsburgh, Pa.
*American Steel & Wire Co.,
Rockefeller Bldg., Cleveland, O.
Barnes, Wallace, Co., The,
Div. Associated Spring Corp.,
Bristol, Conn.
Duer Spring & Mfg. Co.,
Pittsburgh, Pa.
Fort Pitt Spring Co.,
P. O. Box 1377, Pittsburgh, Pa.
Hubbard, M. D., Spring Co.,
442 Central Ave., Pontiac, Mich.
Lee Spring Co., Inc.,
30 Main St., Brooklyn, N. Y.
Pittsburgh Spring & Steel Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St.,
Corry, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works,
Philadelphia, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Wickwire Spencer Steel Co.,
500 Fifth Ave., New York City.

SPRINGS (Alloy)
Pittsburgh Spring & Steel Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.
Fort Pitt Spring Co.,
P. O. Box 1377, Pittsburgh, Pa.

SPRINGS (Coil & Elliptic)
Pittsburgh Spring & Steel Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

SPRINGS (Oil Tempered—Flat)
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Pittsburgh Spring & Steel Co.,
Farmers Bank Bldg.,
Pittsburgh, Pa.

SPRINKLERS (Automatic)
Grinnell Co., Inc., Providence, R. I.

SPROCKETS
Chain Belt Co., 1660 W. Bruce St.,
Milwaukee, Wis.

SPRUE CUTTERS
Shuster, F. B., Co., The,
New Haven, Conn.

STACKS (Steel)—See BRIDGES, ETC.

STAINLESS STEEL—See BARS, SHEETS, STRIP, PLATES, ETC.

STAMPINGS
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Barnes, Wallace, Co., The, Div.
Associated Spring Corp.,
Bristol, Conn.
Crosby Co., The,
183 Pratt St., Buffalo, N. Y.
Dahlstrom Metallic Door Co.,
Jamestown, N. Y.
442 Central Ave., Pontiac, Mich.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Erdle Perforating Co.,
171 York St., Rochester, N. Y.
Hubbard, M. D., Spring Co.,
442 Central Ave., Pontiac, Mich.
Kirk & Blum Mfg. Co., The,
2838 Spring Grove Ave.,
Cincinnati, O.

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STAMPINGS—Con.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Sheet Metal Specialty Co., Pittsburgh, Pa.
Stanley Works, The, Bridgeport, Conn. New Britain, Conn.
Toledo Stamping & Mfg. Co., 90 Fearing Blvd., Toledo, O.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit, Mich.

STAMPS (Steel)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

STAPLES (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STARTERS (Electric Motor)
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.

STEEL (Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Firth-Sterling Steel Co., McKeesport, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Washburn Wire Co., Phillipsdale, R. I.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

STEEL (Alloy, Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

STEEL (Clad—Corrosion Resisting) (*Also Stainless)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Copperweld Steel Co., Warren, O.
*Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Superior Steel Corp., Carnegie, Pa.

STEEL (Cold Drawn)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Kidd Drawn Steel Co., Aliquippa, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Corrosion Resisting)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Firth-Sterling Steel Co., McKeesport, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
National Tube Co., Frick Bldg., Pittsburgh., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (Die)
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Milne, A., & Co., 741 Washington St., New York City
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (Drill)
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Milne, A., & Co., 741 Washington St., New York City

STEEL (Electric)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (High Speed)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Milne, A., & Co., 741 Washington St., New York City
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (High Tensile, Low Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Nitriding)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL (Rustless)—See STEEL (Corrosion Resisting)

STEEL (Screw Stock)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Spring)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Fort Pitt Spring Co., P. O. Box 1377, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York City. Phillipsdale, R. I.

STEEL (Stainless)—See STEEL (Corrosion Resisting)

STEEL (Strip, Copper Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Thomas Steel Co., The, Warren, O.

STEEL (Strip, Hot and Cold Rolled) (*Also Stainless)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
*American Rolling Mill Co., The, 210 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
*Firth-Sterling Steel Co., McKeesport, Pa.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St. ,Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Sharon Steel Corp., Sharon, Pa.
*Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City. Phillipsdale, R. I.
Weirton Steel Co., Weirton, W. Va.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

STEEL (Strip, Tin Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Strip, Zinc Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Structural) (*Also Stainless)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace, Buffalo, N. Y.

WHERE-TO-BUY

STEEL (Structural)—Con.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Standard Steel Fabricating Co. & Boiler Works, Inc., 1640 W. Hanford St., (Harbor Island), Seattle, Wash.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Treadwell Construction Co., Midland, Pa.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Tool)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Beals, McCarthy & Rogers, Inc., 40-62 Terrace St., Buffalo, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Copperweld Steel Co., Warren, O.
Crucible Steel Company of America, 405 Lexington Ave., New York City.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Forgings & Castings Corp., 1350 Jarvis St., Ferndale, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Kidd Drawn Steel Co., Aliquippa, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Milne, A., & Co., 741 Washington St., New York City
National Broach & Mach. Co., 5600 St. Jean, Detroit, Mich.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL BUILDINGS—See BRIDGES, BUILDINGS, ETC.

STEEL DOORS & SHUTTERS—See DOORS & SHUTTERS

STEEL FABRICATORS—See BRIDGES, BUILDINGS, ETC.

STEEL FLOATING AND TERMINAL EQUIPMENT
Dravo Corp. (Engin'r'g Works Div.), Neville Island, Pittsburgh, Pa.

STEEL PLATE CONSTRUCTION
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Standard Steel Fabricating Co. & Boiler Works, Inc., 1640 W. Hanford St., (Harbor Island), Seattle, Wash.
Treadwell Construction Co., Midland, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

STEEL PLATE WORK (Special)
National Wrought Iron Annealing Box Co., Washington, Pa.

STELLITE
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.

STOKERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Canton Pattern & Mfg. Co., The, Andrews Pl. S. W., Canton, O.

STONES (Honing)
Bay State Abrasive Products Co., Westboro, Mass.

STOOLS
Superior Mold & Iron Co., Penn, Pa.

STOPPERS (Cinder Notch)
Bailey, Wm. M. Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

STOPPERS (Rubber)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

STORAGE BATTERIES—See BATTERIES (Storage)

STRAIGHTENING MACHINERY
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Medart Co., The, 3520 de Kalb St., St. Louis, Mo.
Shuster, F. B., Co., The, New Haven, Conn.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.

SULPHURIC ACID
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
New Jersey Zinc Co., 160 Front St., New York City.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

SWITCHES (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2700 E. 79th St., Cleveland, O.
General Electric Co., Dept. 166-S-L, Nela Park, Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TACHOMETERS
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.

TANK LININGS
Ceilcote Co., 750 Rockefeller Bldg., Cleveland, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.

TANKS (Pickling)
Atlas Mineral Products Co. of Pa., Mertztown, Pa.
Fleming Tank Co., Inc., 31st St. & Penn Ave., Pittsburgh, Pa.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.

TANKS (Storage, Pressure, Riveted, Welded)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.

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- Machinery Castings
- Acid Resisting Castings
- Phosphorized Copper
- Hot Metal Ladle Car Bearings
- Locomotive and Car Journal Bearings
- Babbitt Metals

NATIONAL BEARING METALS CORP.
PITTSBURGH, PENNA.
Clearing Ill. (Chicago District) — Meadville, Pa.

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CASTINGS
Wood Patterns a Specialty
Commercial and Industrial Stokers
THE CANTON PATTERN & MFG. CO.
210 ANDREWS PLACE, S.W. — CANTON, OHIO

TANKS (Storage, Pressure, Riveted, Welded)—Con.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

TANKS (Wood or Steel, Rubber or Lead Lined)
Fleming Tank Co., Inc., 31st St. & Penn Ave., Pittsburgh, Pa.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

TANKS & TOWERS
Treadwell Construction Co., Midland, Pa.

TANTALUM CARBIDE
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.

TAPS AND DIES
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

TERMINALS (Locking)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1640 W. Hubbard St., Chicago, Ill.

TERNE PLATE—See TIN PLATE

TESTING MACHINERY (Materials)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

THERMOMETERS
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stanton Ave., Philadelphia, Pa.

THREAD CUTTING TOOLS
Landis Machine Co., Inc., Waynesboro, Pa.

TIE PLATES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

TIN PLATE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Washington Tin Plate Co., Washington, Pa.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TIN PLATE MACHINERY
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Wean Engineering Co., Warren, O.

TIN POTS
National Wrought Iron Annealing Box Co., Washington, Pa.

TONGS (Chain Pipe)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TONGS (Rail Handling)
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.

TOOL BITS (High Speed)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Jessop Steel Co., 584 Green St., Washington, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TOOL BITS (Tantalum Carbide)
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOL HOLDERS
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TOOLS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Ingersoll-Rand Co., Phillipsburg, N. J.

TOOLS (Precision, Lathe, Metal Cutting, etc.)
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tantalum Carbide)
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tipped, Carbide)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TORCHES AND BURNERS (Acetylene, Blow, Oxy-Acetylene)
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

TOWBOATS
Dravo Corp. (Engin'r'g Works Div.), Neville Island, Pittsburgh, Pa.

TOWERS (Transmission)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

TOWERS (Tubular Hoisting)
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.

TOY PARTS
Townsend Co., New Brighton, Pa.

TRACK ACCESSORIES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Industrial Equipment Corp., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

TRACK BOLTS
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TRAILERS
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRAILERS (Arch-Girder)
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRAMRAILS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 Depot St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRANSMISSIONS—VARIABLE SPEED
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

TRAPS (Compressed Air)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (High Pressure Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TREADS (Safety)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

TROLLEYS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Ford Chain Block Div. American Chain & Cable Co. Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCK CRANES
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

TRUCKS AND TRACTORS (Electric Industrial)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCKS AND TRACTORS (Gasoline Industrial)
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.

TRUCKS (Dump-Industrial)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TRUCKS (Hydraulic Lift)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TRUCKS (Industrial)
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRUCKS (Lift)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TUBE MILL EQUIPMENT
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.

TUBES (Boiler)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit, Mich.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBES (Brass, Bronze, Copper, Nickel Silver)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

TUBES (High Carbon)
Ohio Seamless Tube Co., Shelby, O.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.

TUBING (Alloy Steel) (*Also Stainless)
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit, Mich.
*National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

TUBING (Copper, Brass, Aluminum)
American Brass Co., The, Waterbury, Conn.
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Shenango-Penn Mold Co., Dover, O.

TUBING (Seamless Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

TUBING (Seamless Steel)
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.
Standard Tube Co., The, 14600 Woodward Ave., Detroit, Mich.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBING (Square, Rectangular)
Ohio Seamless Tube Co., Shelby, O.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.

TUBING (Welded Steel)
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit, Mich.
Ohio Seamless Tube Co., Shelby, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBULAR PRODUCTS
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit, Mich.
Ohio Seamless Tube Co., Shelby, O.
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.

TUMBLING BARRELS (Coke Testing)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

TUNGSTEN CARBIDE
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TUNGSTEN CARBIDE (Tools and Dies)
Carboloy Co. Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

WHERE-TO-BUY

TUNGSTEN METAL AND ALLOYS
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

TURBINES (Steam)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TURBO BLOWERS—See BLOWERS

TURNTABLES
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TURRET LATHES—See LATHES (Turret)

TUYERES
Climax Fire Brick Co., Climax, (Clarion Co.), Pa.

TWIST DRILLS
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

VACUUM CLEANERS
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

VALVE CONTROL (Motor Operated Units)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

VALVES (Automatic, Non-Return)
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.

VALVES (Blast Furnace)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

VALVES (Brass, Iron and Steel)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Check)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Control—Air and Hydraulic)
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Electrically Operated)
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Gas and Air Reversing)
Blaw-Knox Co., Blawnox, Pa.

VALVES (Gate)
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Crane Co., The, 836 So. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.
Western Gas Div. Koppers Co., Fort Wayne, Ind.

VALVES (Globe)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Hydraulic)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Vickers, Inc., 1400 Oakman Blvd., Detroit, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

VALVES (Needle)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Open Hearth Control—Oil, Tar, Steam & Air)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Proportioning)
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.

VALVES (Steam and Water)
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES AND FITTINGS—See PIPE FITTINGS

VANADIUM
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

VIADUCTS (Steel)—See BRIDGES, ETC.

WALKWAYS—See FLOORING—(Steel)

WASHERS (Iron and Steel)
Hubbard, M. D., Spring Co., 442 Central Ave., Pontiac, Mich.
Thompson-Bremer & Co., 1640 W. Hubbard St., Chicago, Ill.

WASHERS (Lock)
American Nut & Bolt Fastener Co., Pittsburgh, Pa.
Beall Tool Co., East Alton, Ill.
Butcher & Hart Mfg. Co., Toledo, O.
Eaton Mfg. Co., Massillon, O.
National Lock Washer Co., The, Newark, N. J. and Milwaukee, Wis.
Philadelphia Steel & Wire Corp., Germantown, Philadelphia, Pa.
Positive Lock Washer Co., Newark, N. J.
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1640 W. Hubbard St., Chicago, Ill.
Washburn Co., The, Worcester, Mass.

WASHERS (Spring)
American Nut & Bolt Fastener Co., Pittsburgh, Pa.
Beall Tool Co., East Alton, Ill.
Butcher & Hart Mfg. Co., Toledo, O.
Eaton Mfg. Co., Massillon, O.
National Lock Washer Co., The, Newark, N. J., and Milwaukee, Wis.
Philadelphia Steel & Wire Corp., Germantown, Philadelphia, Pa.
Positive Lock Washer Co., Newark, N. J.
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1640 W. Hubbard St., Chicago, Ill.

WELDED STEEL CONSTRUCTION
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

WELDERS (Electric—Arc)
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Dept. ST-11, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Progressive Welder Co., 3031 E. Outer Drive, Detroit, Mich.

WELDERS (Electric-Resistance)
Federal Machine & Welder Co., Dana St., Warren, O.
Taylor-Winfield Corp., Warren, O.

WELDING
Bartlett-Hayward Div. Koppers Co., Baltimore, Md.
Koch, George, Sons, Inc., 2112 Pennsylvania St., Evansville, Ind.
Lincoln Electric Co., The, Cleveland, O.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

WELDING (Welded Machine Steel Bases)
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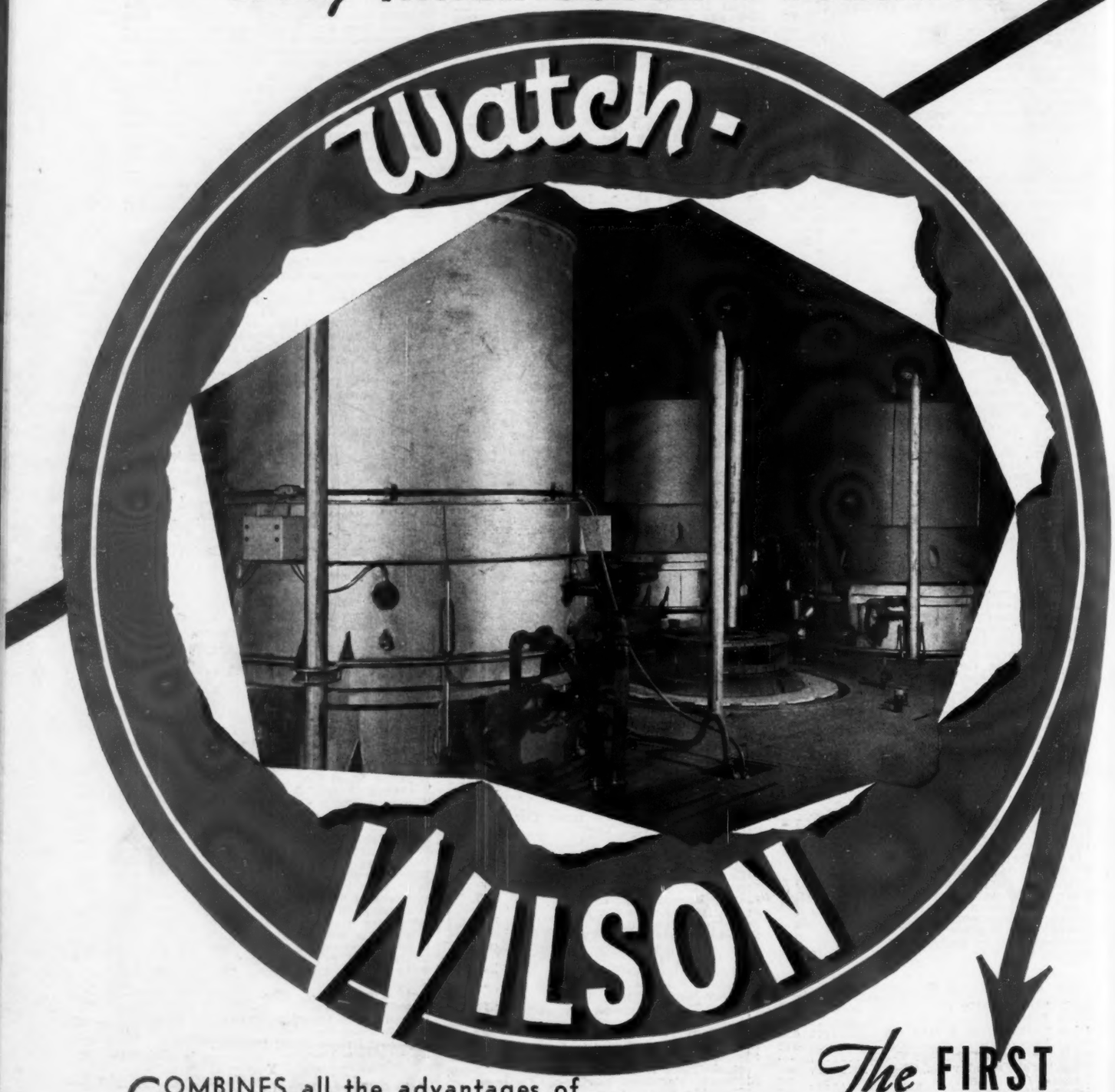

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Here at WASHBURN, backed by our own Steel Mill, with the streamlined production of our new New York plant, we are doing our best to keep abreast of your demands.

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Reader COMMENTS

Readers are invited to comment upon articles, editorials, reports, prices or other editorial material appearing in STEEL. The editors cannot publish unsigned communications, but at their discretion may permit a writer to use a pseudonym when a bona fide reason exists for with-holding his identity. Letters should be brief—preferably not exceeding 250 words

Action in the Pacific

To the Editor:

The most important question for us today is: What can be done to assure the safety of the United States in face of the forces which now seek, or may hereafter seek, to destroy us.

The enclosed leaflet reviews our present situation. It advances the view, the result of long study and thought, that it is essential to our security that Japan be prevented from continuing its drive into the South Pacific.

I urge your earnest attention to the ideas expressed in the pamphlet. They will convince you, I believe, that national peace and safety demand immediate action by the administration and congress.

WARREN A. SEAVEY
Harvard Law School,
Cambridge, Mass.

EDITOR'S NOTE—The pamphlet referred to contains a reprint of an article by W. Barton Leach, of the Harvard law school, in the *New York Times*, on the road to peace by action in the Pacific, and a proposal for action in the Far East which appeared in the December *Atlantic* over the signatures of a number of members of the faculty of the same school.

In the latter article four measures are suggested for the United States:

Place a complete embargo on all trade with Japan.

Extend all possible aid to China, both in money and in materials.

Arrange with Great Britain and the Dutch government for the use of British, Dutch and American bases and ports in the Orient.

Arrange our naval forces so as to make possible a blockade of Japanese trade should Japan attack us, or move against Singapore or the East Indies.

Perfection, Where Art Thou?

To the Editor:

Four score and seven years ago, our fathers brought forth upon this continent a lot of second hand machinery, and since that time we have been producing more junk than the rest of the world put together.

We have now embarked upon a great industrial era. Our great engineers have repaired these machines to such a degree of automatic perfection, that they can turn out more junk without the help of man, than they could with his help.

"These machines are almost human. They will more than double our production." These are the reports of a staff of engineers to the general manager. But the general manager is not happy. He never went to college. He admits it doesn't take many men to operate this fine battery of new machines, but his receiving and shipping room force is doubled, not to handle the fruits of progress, but to receive and reship larger quantities of junk.

His staff of engineers no longer wear overalls and carry oil cans. They sit in paneled offices surrounded by teletypes, telephones, and blonde stenographers. They are answering complaints of dissatisfied customers with the appeasement of Hitler and the diplomacy of Neville Chamberlain. Even his favorite motto, "Better things for better living," has been changed to "Nothing is perfect under the sun."

His customers suspect that his factory is a W. P. A. project for the blind and they send him prints in Braille, and when he complains to his staff that any similarity between the prints and his products is purely coincidental, his staff suspects subversive activities. Suddenly, he remembers that these machines he just bought were almost human and like Frankenstein, have made slaves of their masters.

Didn't Lincoln free the negro slaves? He never went to college either. Why couldn't he free the white slaves of industry? He becomes intensely patriotic and steals into his factory in the black of night with a sledgehammer in each hand, and as rows of polished gears flash their shiny teeth at him, he smashes everything in sight.

The moral of this story is, "This man might be your boss so watch out for him!" or "If you want perfect material, that's your hard luck."

HENRY J. KNAPP
F. W. Sickles Co.,
Springfield, Mass.

Likes the Yearbook

To the Editor:

We received our copy of your Yearbook this morning and think it is a very nice job. It is very attractively arranged and cannot help but be of interest to everyone or anyone in the metalworking business.

We like our advertisement and the position you have given it and hope for many good inquiries. We wish you all a happy, prosperous new year.

EDGAR G. BEHR
President,
Wayne Chemical Products Co.,
Detroit

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